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JPRS-EST-89-020 CONTENTS 16 JUNE 1989

SUPERCONDUCTIVITY

EAST EUROPE

COMPUTERS

FACTORY AUTOMATION, ROBOTICS

AEROSPACE, CIVIL AVIATION

ESA X-Ray Observatory Described

MI890272 Friedrichsahfen DORNIER POST in English No 1,89, pp 51-55

[Excerpts] [Boxed item, p 51] XMM - the X-ray Multi-Mirror satellite is a high-throughput X-ray spectroscopy facility, which was selected as second cornerstone project in ESA's long-term plan "Space Science: Horizon 2000." This plan satisfies the highest research priorities in the fields of solar system science and astronomy through four major missions (cornerstones). During its 10 year mission, XMM will provide astrophysicists with the capability to study large and small-scale structures of the Universe with unprecedented sensitivity in the 0.1 - 10 keV X-ray band and with simultaneous coverage in the optical/UV band. The main technological challenges lie in the payload area: the lightweight Multi-Mirror assemblies for the telescopes, the medium-resolution X-ray reflection grating spectrometers, and suitable CCD-arrays for the focal instruments. [End boxed item]

ESA's Exosat mission was launched in 1983. It carried two imaging X-ray telescopes and emphasized high resolution imaging with broadband spectroscopic, timing, and variability measurements and dispersive grating spectroscopy of the brightest sources. Rosat, the German national X-ray satellite led by Dornier, will perform an all sky survey of X-ray sources and in addition more detailed observations of selected sources during its 2-3 year mission beginning in 1990.

ESA's XXM will be a third generation mission, a facility class observatory with a sensitivity improvement of greater than two orders of magnitude over existing missions. It will provide the capability to both image and take astrophysical measurements from X-ray sources with high sensitivity. Observations with an X-ray observatory with the collecting power of XMM will have considerable impact on the study of almost every topic in galactic and extragalactic X-ray astronomy. Some of the outstanding observational possibilities that can be anticipated from the use of high throughput X-ray spectroscopic and imaging instruments are highlighted below.

Possibilities of Observation

The study of the structure of the Universe on various size scales is an important objective of present day astronomy. Investigation of the diffuse extragalactic X-ray background is necessary to establish the existence of large scale structural features. XMM will investigate the X-ray background with high sensitivity and good resolution.

Clusters of galaxies form a class of spatially extended X-ray emitters. Einstein observations provided insight into cluster evolution, structure, and the distribution of the X-ray emitting gas. Although the present data provides important clues about the origin of such clusters, a detailed analysis of any particular cluster is not possible without a better knowledge of its astrophysical properties. XMM is ideally suited to conduct spatially resolved spectroscopy since it provides the high throughput necessary for adequate photon statistics in each spectral line and an extended bandwidth (0.1 - 10 KeV). Further, evolutionary trends in cosmologically young clusters can be investigated by observing distant clusters. XMM has the capability to detect and image distant clusters over a wide bandwidth and will therefore contribute in a major way to the assessment of models of cluster evolution.

Active galaxies have been observed as class of highly luminous X-ray objects whose emissions seem likely to provide important clues to the nature of their central energy sources, to the complex distribution of gases around the nucleus and possibly to understanding the origin of the diffuse X-ray background.

XMM will play a crucial role in furthering our understanding of these important and interesting objects by providing very large samples of all kinds of active galaxies.

The high collecting power (high throughput) of XMM also dramatically increases the possibility of detailed studies of the X-ray properties of other "normal" galaxies. The study of the properties of individual X-ray sources in other galaxies has distinct advantages over observations of such sources in our own galaxy. The X-ray luminosity of the observed objects in other galaxies can be accurately established since the distance to the source is also accurately known. The sensitivity of XMM will allow the detection of all high luminosity X-ray sources in galaxies up to 60 million light years away. Einstein was only able to detect such stars in the Andromeda galaxy, 3 million light years away.

X-rays are generated by the interactions of energetic particle flux with matter and were known to be produced on a planetary scale in the Earth's aurorae. Einstein was the first observatory to detect the X-ray flux from Jupiter's magnetosphere. The observed X-ray spectrum and its spatial distribution were used to infer the nature of the flux precipitating onto the planet and the power lost from the magnetosphere to the atmosphere in the process. The additional sensitivity of XMM is sufficient to extend the studies to other planetary members of the Solar System.

System Description

In March 1998, the XMM satellite will be launched on an Ariane 42L into a highly eccentric 24 hour orbit (initial perigee: 1000 km; initial apogee: 70,565 km). A major advantage of this orbit is that the spacecraft will spend more than 17 hours per day above the radiation belts (i.e., above 40,000 km altitude) with continuous contact to a single ground station (Perth, Australia).

The XMM model payload consists of three 7.5 m focal length telescopes and an Optical Monitor. Each telescope consists of a highly nested Wolter I mirror system which focuses the incoming X-rays onto a CCD detector located in the focal plane. Two of the telescopes also have reflection gratings located behind the mirror modules for medium-resolution spectroscopic measurements.

The XMM spacecraft configuration is engineered around the three telescopes which are grouped together within a single large tube that forms the basic structure of the spacecraft. The supporting bus equipment is accommodated in two compartments. These two compartments enclose the tube structure, except for two large cutout sections for the Solar Arrays in stowed configuration. A sun-shield protects the cold plates of the focal instruments, and a large mirror door protects the mirror modules from direct sunlight.

Spacecraft

XMM will be three-axis stabilized with one side of the satellite always sun-pointing within plus or minus 20 °. The initial orbit acquisition, after separation from the Ariane launcher, requires a small apogee boost which is performed by large 20 N thrusters. Subsequent small orbit maintenance manoeuvres are effected by small (is less than or equal to 2 N) thrusters.

The AOCS of XMM will adhere to ESA's Modular AOCS concept and will comprise the following sensors and actuators:

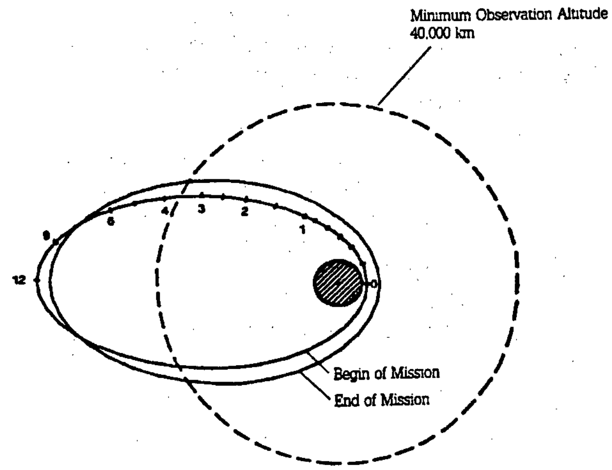
- Three Star Trackers
- Two Fine Sun Sensors
- One Gyropackage
- Four Coarse Sun Sensors
- Four Reaction Wheels (plus or minus 30 N ms each)
- Hydrazine RCE
- 20 N thrusters for apogee burn
- 2 N thrusters for orbit times and attitude control.

The main AOCS performance requirements are state-of-the-art; the most demanding of these requirements is the pointing stability requirement:

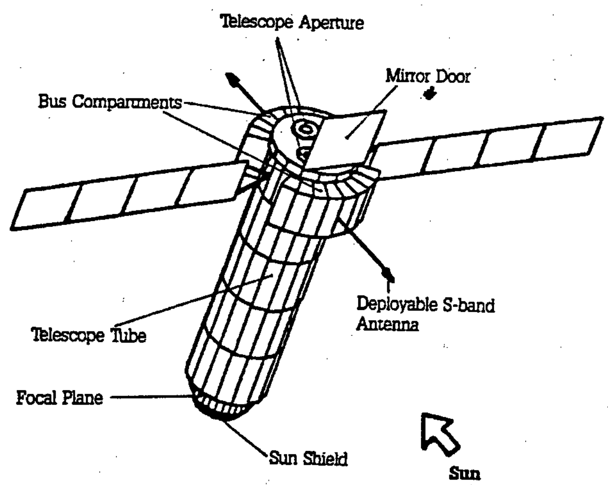
Absolute pointing	Less than or equal to 60 arcmin
Pointing stability	Less than or equal to 5 arcsec/2 min
	Less than or equal to 30arcsec/10 h
Attitude reconstitution (off-line)	Less than or equal to 10 arcsec

The most demanding thermal control requirements are imposed by the X-ray telescope:

- the different CCD detectors of the focal instruments need to be held at -100° C and at -70° C by means of cold plate radiators and need to be stabilized within plus or minus 1 K.



Geometry of the 24 hour highly eccentric orbit (inclination 60°)

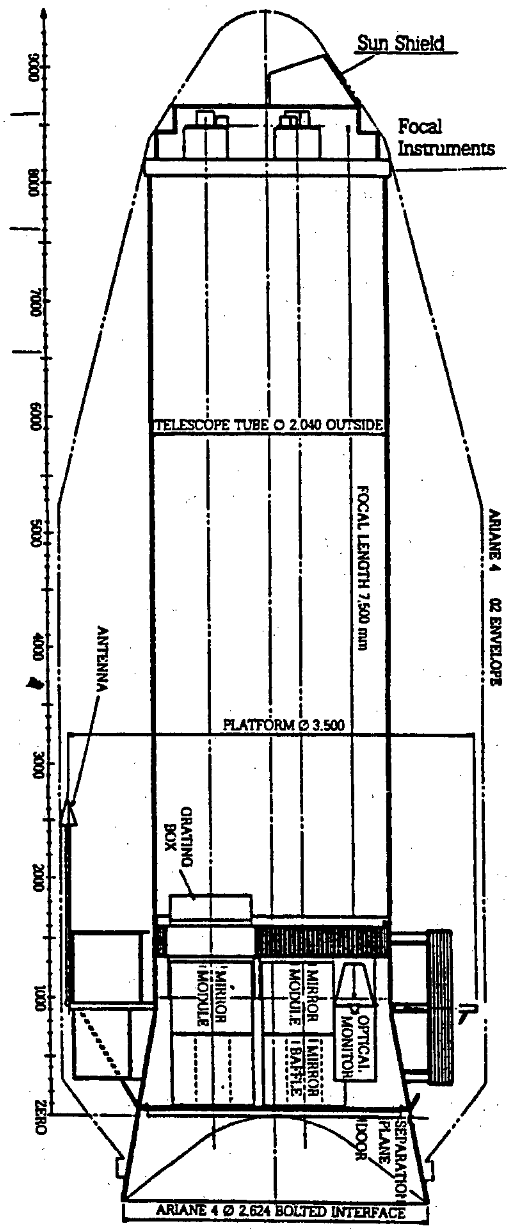


XMM: deployed flight configuration

- the mirror modules be maintained at 20° C and are permitted a very small radial temperature gradient only. In order to achieve this it is necessary to mount long heated baffles in front of the mirror modules (i.e., between the mirror modules and cold space). The power required to heat these baffles is a considerable amount (25%) of the total spacecraft power requirement.
- the temperatures of the telescope structure (Telescope Tube, Mirror Support Platform, Focal Plane Platform) need to be controlled within narrow limits in order to avoid thermo-mechanical excursions affecting the telescope pointing axis.

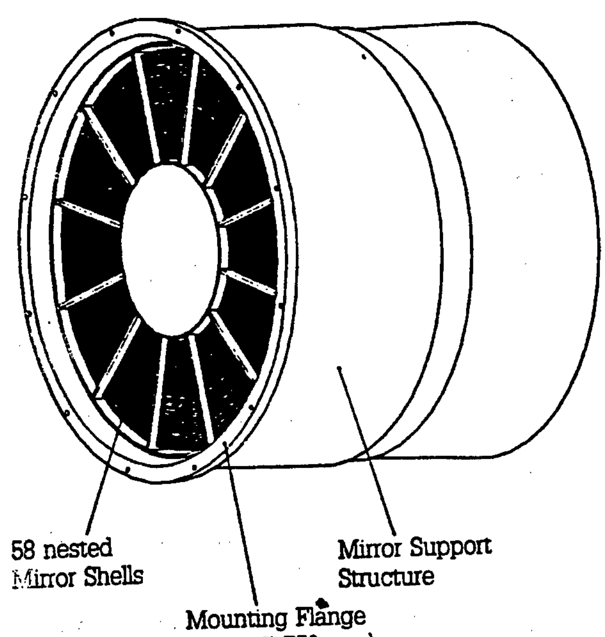
The complete spacecraft power requirement is 970 W which is supplied from a 15 square meters Advanced Rigid Array type solar array deployed symmetrically to both sides of the telescope tube and interfacing directly with the spacecraft bus. During eclipse periods, which may last up to 55 minutes, spacecraft power is supplied by NiH_2 or NiCd batteries.

Any on-board processing of payload information will be performed within the payload supplied instrument data handling subsystem. The payload data will be combined with spacecraft housekeeping data by the spacecraft's data handling subsystem. The combined data will then be convolutional and Reed-Solomon coded before transmission via S-band to the Perth ground station. The two S-band antennae are mounted on short booms outside the bus compartments. The launch mass of XMM is 2340 kg (with a margin of 20%). This allows to launch XMM with AR42L. The overall dimensions of XMM are indicated in the configuration drawing. The total length of the XMM spacecraft is approximately 9 meters, the basic tube structure has a diameter of 2.04 meters while the bus compartments have an external diameter of 3.50 meters. These dimensions mean that XMM is considerably larger than any satellite yet built by ESA. The assembly, integration and verification (AIV) of XMM therefore requires careful planning. Spacecraft testing facilities currently available or definitely planned to be operational by the 1990's in Europe are not large enough to allow all tests to be carried out on the complete spacecraft. Hence, an AIV program built around the testing of four assemblies—focal plane assembly, telescope tube assembly, mirror module assembly, and bus assembly has been established. Assembly and integration of the complete spacecraft will require clean areas 12 meters high. Even transportation of the satellite within Europe and to the launch site either as assembly level or as a complete spacecraft requires careful considerations.



Launch configuration in Ariane 4 (long fairing)

Boxed item, p 54: The achievable mission characteristics of XMM can be summarized as follows:—spatial resolution: less than 30 arcsec (HEW)—wide bandwidth: 0.1-10 keV—large collection area of X-ray telescopes: 6000 cm^2 at 2keV 3000 cm^2 at 7keV—imaging, broad-band spectrophotometry: resolving power of CCDs: E/gDE = 5 to 60 for 0.1-10keV—simultaneous medium-resolution spectroscopy: E/gDE is greater than or equal to 250 at 0.5keV—simultaneous monitoring of target in optical/UV band—continuous observation of a target for up to 18 hours, afforded by deep orbit—real-time monitoring/control of the observatory—long-duration facility: greater than 10 years (goal). [End boxed item]



Mirror module. View on exit plane

Payload

Each XMM telescope consists of a mirror module, consisting of 58 grazing incidence Wolter I type confocal parapoloid-hyperboloid mirror shells, which focus the incoming X-rays onto a CCD array detector located at the on-axis focus of the mirror module. In addition, two telescopes incorporate a reflection grating in the X-ray beam and a CCD strip detector at the off-axis focus.

Each mirror shell will be produced using the replication technique. The successful development of the replication technique was demonstrated during the production of high quality X-ray mirrors for Exosat. For XMM, the technique involves the manufacture of a steel mandrel as the mold for production of a CFRP carrier shell. A glass mandrel is also manufactured to the shape and surface finish required for the mirror shell. A gold reflecting layer is deposited onto the glass mandrel and the mandrel lowered into the carrier shell. Expoxy is injected between the carrier shell inner surface and the mandrel to form a separation layer of few tens of microns thick. After curing of the epoxy, the mandrel is separated from the carrier by thermal shock which leaves the gold X-ray reflecting layer attached to the carrier. Post-curing of the epoxy at elevated temperature then provides long-term stability.

The dimensions of the Mirror Modules are 600 mm length and 700 mm outer diameter. The minimum packing distance between shells is 1 mm. The mass estimate ranges between 170 kg (goal) and 220 kg (specified) per mirror module.

The resolution of the X-ray images obtained from XMM will be determined mainly by error contributions of the Mirror Module: mirror module manufacturing assembly and integration errors; thermal environment; CFRP ageing; launch induced deformations. The achieveable resolution is predicted to be less than 30 arcsec.

Both the imaging CCD detectors at the on-axis foci of the mirror modules and the spectroscopy CCD strip detectors used in conjunction with the reflection gratings are currently under development. CCD's are ideal for single photon X-ray imaging and spectroscopy. They have a high quantum efficiency over a broad energy range, high spatial resolution, low readout noise, and an energy resolution approaching 100 at high energy levels.

Reflection gratings have been chosen for XMM rather than transmission gratings as they offer a factor of 2-3 increase in effective area and, in addition, the possibility of higher wavelength resolution (gD equivalent to 0.1 Angstrom).

In order to alleviate the need for intense observational support from Earth-based observatories, an optical/ultraviolet telescope is included in the XMM model payload: the Optical Monitor. It allows to observe stars down to 24 th magnitude (in 1000 s) with a positional accuracy of 1 arcsec over its 8 arcmin field-of-view. In addition, the Optical Monitor can be used to provide pointing calibration for the three X-ray telescopes.

Outlook

Following the XMM Configuration Study, the Agency will fund a System Definition Study Phase beginning in early 1989 in order to establish a satellite concept for the selected payload. In parallel, the Agency will fund technology and development contracts in order to avoid technology and schedule risks on the payload side.

SNECMA Automates Turbine Blade Production

36980228a Paris MACHINE MODERNE in French Apr 89 pp 39-40

[Article: "SNECMA [National Company for Aircraft Engine Study and Manufacturing] Automates Turbine Blade Machining"]

[Text] **To reduce the difficult and repetitive work involved in machining turbine blades, a team of seven SNECMA [national company for research and construction of aircraft engines] employees has designed an automated cell. It is now operational for six types of turbine blades used on jet engines of the CFM-56 family; it produces 6,000 such blades per month.**

Among other things, the SNECMA plant in Gennevilliers (Hauts-de-Seine) manufactures turbines for the CFM-56, M-53 and M-88 engines. Its mechanical division just started using an automated machining unit.

The workshop receives forged or cast blanks and delivers finished turbine blades ready for assembly. The operations performed include radius calibration and deburring after machining. Although deburring can be done, for instance, by frictional finishing or tumbling, until now the radius calibration on turbine blade attachment mounts required manual machining. To reduce, or even eliminate this difficult but repetitive work, for which no automated equipment existed on the market, an original experiment, calling for team work, was made.

A team of seven people (one engineer, two foremen, two assistants from the setup department, and two workers) designed the automated cell. The only prerequisite was that they should use an ABB [Swedish General Electric Corporation-Brown Boveri] Irb-2000 robot. The robot had been selected by a preliminary feasibility study.

2.5 Minutes per Turbine Blade

The team, formed in January 1987, went to work immediately. Weekly meetings enabled them to direct their efforts and decide what should be undertaken, for instance with respect to tests, tours of existing facilities or participation in trade shows.

The operating principles of the cell, the nature of the equipment used, the design of the tools and fixtures were validated through tests made on demonstration equipment at the robot manufacturer's. This approach set the configuration of the cell and its layout.

At the same time, it also provided the equipment required for the acceptance tests of the manipulator, in February 1988.

The cell consists of two magazines of six pallets each, in which the turbine blades are stored. A milling head adjusts for geometric variations from head to head. Brushing turrets and a positioning device complete the cell.

At cycle start, the robot identifies the part type by means of the pallet.

It invokes the corresponding machining program. A part detector checks that the turbine blade has actually been grasped by the robot gripper and enables machining. At cycle end, the part is put back onto the pallet. Another part is then machined.

430 Hours for 6,000 Parts

The average cycle for a CFM-56 compressor blade is 2.5 minutes, i.e. about the time an experienced machinist would require to do the work by hand.

In a first stage, the cell is manned by two two-men shifts. Their job consists in setting up the parts and equipment at the beginning of the day and troubleshooting when problems occur. Without the robot, two more persons would be required to do the same job at each station.

Its magazine capacity and tool service life enable the cell to work for several hours without operator's intervention. At night, it works without supervision. Thus, it can work 430 hours per month, during which it produces 6,000 parts.

The cell is now operational for six types of compressor blades of the CFM-56 engine family. It will be adapted to machine other parts. A second cell for mobile turbine blades is under study. It should be set into service during 1989. Subsequent developments involving turbine nozzles will also be launched.

The cooperative approach used the first time will also be used for subsequent projects.

FRG: MBB Increases Orders for Airbus A-330/A-340

MI890192 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 27 Jan 89 pp 14-15

[Text] Messerschmitt-Boelkow-Blohm (MBB) has thus far placed orders valued at over $1 billion (through at least the year 2010) for the long-range Airbus A-340 and for the twin-jet A-330 (maiden flights are scheduled for 1991 and/or 1992) with its partners and supplier companies. German companies are increasingly represented as suppliers of the major components and subsystems for the Airbus.

Apart from the Liebherr Aero-Technik company, which for years has served as a coordinator for large systems on several Airbus models, new examples of such supply companies include Nord Micro in Frankfurt, which for the first time supplied a complete Airbus subsystem for the A-320 model and is once again active as a subcontractor for the A-330/A-340 models. Another example is Mannesmann-Rexroth in Lohr am Main, which for the first time will be the prime contractor for an important system on the A-330/A-340.

Roughly one-third of the Airbus will be built in the FRG, including the fuselage, vertical tail, final wing assembly, and the interior equipment of the cabin. The following contracts have already been concluded:

Nord Micro will develop and manufacture the entire cabin pressure control system. The total value of this order to the Frankfurt speciality firm will be roughly $70 million. (Since airplanes are sold in dollars worldwide, MBB also writes its subcontracts with German suppliers in dollars.)

Liebherr Aero-Technik in the Allgaeu area will supply the slat actuation system for the long-range Airbus and the twin-jet A-330. In addition, this company will develop and manufacture the hydraulic actuation and control units as well as electrohydraulic safety components (power control units/wing tip brakes) for the entire secondary flight-control system. This will be done in cooperation with the Lucas company in England. In cooperation with Allied Signal (United States) and ABG Semca (France), Liebherr is the prime contractor for the entire environmental control system. The total value of these orders is over $500 million.

The Friedrichshafen Gearwheel Factory, in cooperation with Dowty Rotol in the UK, has received the contract for the development and manufacture of the flap actuation system. In this cooperative effort the Friedrichshafen factory is responsible for the development and production technologies of a new generation of actuation units, specifically for the rotary drive systems. The total value of the order comes to about $200 million.

Mannesmann-Rexroth, Mannesmann AG's primary company for electrohydraulic, electric, and mechanical drive systems, has used the A-330/A-340 program to gain access to a new, interesting market. With subcontracts assigned to the American company, Hydraulic Research Textron, and the French firm, Ratier Figeac, Mannesmann-Rexroth of Lohr am Main is now an Airbus supplier and prime contractor for the spoiler airbrake actuation systems. The total value of this order is over $50 million.

Garett GmbH in Raunheim near Frankfurt will supply the entire auxiliary power unit. This auxiliary turbine provides power for all electric systems and/or for the cabin air conditioning, for example, when the aircraft is on the ground and its jet engines are switched off.

About 50 German suppliers will be working on this order alone. Suppliers include the Bodensee Geraetetechnik GmbH, which will supply the entire electronic installation, and the Friedrichshafen Gearwheel Factory, which has a subcontract for the complete gear box. The total value of this order is close to $250 million.

Space Activity of Swedish Firms Ericsson, SAAB, Volvo Discussed

36980198a Stockholm NY TEKNIK in Swedish 13 Apr 89 p 6

[Article by S.O. Carlsson and J. Melin: "European Cooperation Gives a Boost to Swedish Space Industry"]

[Text] The Swedish space industry is entirely dependent on government financing. Sweden must participate in financing European space projects in order to secure some orders. The European Space Agency, ESA, is responsible for the European space programs. The Swedish space troika, Saab, Volvo, and Ericsson, receives most of the industrial orders from ESA. But Sweden has also supplied equipment to foreign national projects, such as the French and West German communications satellites. But these orders have come in to make sure that the industries of these countries were able to participate in building Tele-X.

Sweden was launched onto the European space map by Tele-X, together with the research satellite Viking, and supplies to the carrier rocket Ariane. Whether we stay there will depend on how much money the Swedish government will invest in space programs in the future.

Government Money Rules [Boxed item, p 6]

Ericsson Radar Electronics (Space)

Products: Complete antenna systems and electronics to the satellite communications systems. Number of employees: 120; Sales: 80 million Swedish crowns per year; Profits: "Distressing" Volume of orders: 80 million Swedish crowns [End boxed item]

The antenna system is the big product. Most of the satellites made in Europe have antennas which Ericsson helped to develop or manufacture. But Ericsson and the other Swedish space industrial concerns do not compete in a free market. Orders are tightly tied to how much money the Swedish government invests in the European space projects.

The basic rule is that about 60 percent of the Swedish investment will be returned as orders to the Swedish companies. Ericsson is about 80 percent dependent on orders from ESA.

The French and West German national communications satellites, TDF and TV-SAT, respectively, have also been important projects for Ericsson. The Swedish Tele-X was the reason behind these contracts. That satellite is built around the same type of platform as the French and West German satellites and therefore Ericsson favored the companies in these countries.

There will be problems for the space operations at Ericsson, if Sweden will not go into the Columbus project and thereby lower the appropriations to ESA. For now, Ericsson and Saab have the same big project, supplies to the communications satellites Eutelsat 2.

For these, Ericsson's most important product is electronics for the communications system, mainly a converter which transforms the frequency between receiver and transmitter in the satellite.

Ericsson also has smaller orders for the other ESA satellites. One of them is the space observatory that will be launched in 1993.

[Boxed item , p 6]

Saab Space

Products: Complete satellite systems and sond rockets. Computers for the satellites and carrier rockets. Number of employees: 220; Sales: 100 million Swedish crowns per year; Profits: "Positive and satisfactory"; Volume of orders: 150 million Swedish crowns. [End boxed item]

Saab Space built the research satellite Viking and was the assistant main supplier of Tele-X. Otherwise, the big project is the computer system. They are on board on the Ariane rockets used for the European satellite launches. Saab computers have also been delivered to a number of research and communications satellites.

At present, the space station Columbus, the shuttle Hermes, and the next generation of carrier rockets, Ariane 5, are the big European investments.

Sweden is already investing money in Hermes and Ariane, and therefore Saab hopes to participate. But no contracts have been signed yet.

Earlier Sweden said no to Columbus when it was suspected that some military research would be part of the project. Kerstin Fredga, among others, at the state delegation for space operations, thinks that the decision should be revoked since there are assurances that Sweden would not be involved militarily. But Saab Space already has other contracts to guarantee operations in the near future. These concern mainly data management

systems for at least four satellites of the Eutelsat 2 type, the joint communications satellite for the European postal services. There are contracts also on computer systems for some scientific satellites under ESA's control.

Orders from ESA make up more than half of Saab's space operations today. Saab has also succeeded in getting a foot in on the American space market.

General Dynamics in the United States has ordered systems from Saab to separate carrier rockets from satellites. [Boxed item , p 6]

Volvo Flygmotor (Space)

Products: Combustion chambers for Ariane 1-5. Turbines for the oxygen- and hydrogen pumps for the main engine in Ariane 5. Number of employees: about 200; Sales: 140 million Swedish crowns in 1988; Profits: "Not money but proficiency in leading edge head technology." [End boxed item]

Since mid 1970's, Volvo Flygmotor has produced the combustion chambers for the main engines of the Ariane rockets, both in stage 1 and stage 2 for every version of the rocket. Today the total production has reached more than 350 discharge nozzles.

Through its know-how in high-tech production and production development, Flygmotor became the secondary supplier to the French engine manufacturer for Ariane. Approximately one hundred people work on combustion chamber production at Flygmotor, and about 80 qualified technicians work on development of new space technology.

Flygmotor's production now goes to Ariane 4; versions 1-3 are no longer used. No ESA money is involved in this production. Launching customers are paying. Money from ESA, however, goes to the development of the new Ariane 5. And two percent of this money comes from Sweden. Most of the Swedish money is returned as orders to the Swedish space industry, to Flygmotor, among others, for their part in the development of Ariane 5.

In this, Volvo Flygmotor has both technological, construction, and production responsibility. Together with the Italian Fiat, it makes an oxygen pump, and with the French SEP, a hydrogen pump to the cryogen engine Vulcain HM 60 in Ariane 5. In addition, it produces combustion chambers for Ariane 5. Volvo is not involved in space operations for the money, the profit margins are too small. Instead, the profits are in learning about leading head technology that can be transferred to other areas. Volvo limits its activities to within ESA. Three test combustion chambers were delivered to India under ESA's protection.

They see for the future within ESA a role in the bilateral technological programs for the new space planes. They are the next big technological challenge. Flygmotor is currently negotiating with several leading ESA-members.

AUTOMOTIVE INDUSTRY

Volkswagen Plans 5-Year Investment in Automation

36980228b Paris L'USINE NOUVELLE in French 20 Apr 89 p 43

[Article by Philippe Escande: "Automation: Volkswagen's Massive Investments"]

[Text] **More than Fr100 billion over 5 years to modernize and automate the production units of the leading German car manufacturer! At the Emden plant alone, nearly 700 robots will be installed to produce 1,200 VW Passat per day.**

To produce 1,200 VW Passat per day, the Volskwagen Emden plant in northern Germany, will soon use nearly 700 robots: 1-1/2 times the number it takes to assemble the Fiat Tipo in Italy, and nearly 3 times as many as for the Renault 19 in France.

With labor costs that are among the highest in the world (Fr130 per hour, compared with Fr75 in Spain), the FRG has no choice but all-out automation. That is why, although its profits remain modest compared with those of its competitors, the leading German manufacturer has adopted an investment plan of unprecedented scope: over Fr100 billion over 5 years! One third of this amount will be spent on the total modernization of SEAT. A new plant will also be built in Martorell, near Barcelona.

As a result, the smaller Volkswagen models are leaving Germany; production of the small Polo will soon be entirely transferred to Spain; many engines already come from Brazil. To prevent the future Golf, which will be introduced in 2 or 3 years, from experiencing a similar fate, the bulk of the planned investment will therefore go to "the plant" (i.e. the Wolfsburg mother plant which still employs 64,000 people) and to the Brussels plant which produces the Passat and Golf.

Emden, near Bremen (10,000 people) prefigures this trend. Of the Fr9-billion investment devoted to the Passat, over Fr4 billion have been earmarked to modernize that plant. The goal is to achieve production of 1,200 cars per day, with as much flexibility as possible. Thus, the high number of robots is due especially to the fact that, during welding, the car body is held in position by robots rather than by a frame lowered over it. An advantage is that the same welding cell will accept either three-compartment models or station wagons. Soon, the cell will also work for Golf models. Flexibility will then be complete: horizontally (all versions of a given model) and vertically (several of the manufacturer's models). A

major first of which Gunter Hartwich, the director in charge of production, has every reason to be proud.

The new Passat is manufactured with 1,000 fewer people. But increased production rates have offset the job loss. This is why people in Emden say that the plant will not be affected by the 12,000 layoffs scheduled to take place at Volkswagen in 1989 and 1990. For once, robots are saving jobs, and they are also slowing down work transfer to other locations.

COMPUTERS

Hamburg AI Institute Funded

36980163a Duesseldorf HANDELSBLATT in German 13 Feb 89 p 10

[Article: "Eight Out of Nineteen Information Technology Professors Are Specialists in Artificial Intelligence"]

[Text] The Free and Hanseatic City of Hamburg wants to enter the nationwide competition for application-oriented basic artificial intelligence (AI) research by opening an AI laboratory. Professor Walther von Hahn, a scientist well-known in expert circles, will, together with Professor Neumann, head the Hamburg "AI Laboratory," which is in its founding phase and will be opened in mid-April.

Computer science institutes devoted to artificial intelligence are now springing up everywhere: a Bavarian Research Center for Science-Based Systems in Erlangen, a Heinz-Nixdorf-Institute in Paderborn, the FAW Institute for Application-Oriented Science Processing in Ulm—and, of course, the German Research Center for Artificial Intelligence (DFKI) located in Kaiserslautern and Saarbruecken. The latter, being an establishment belonging to several firms and institutions, can expect DM 10 to 15 annually over a decade from Bonn.

Hamburg had actually wanted to reel in that big fish. After all, world-renowned AI projects such as the Hamburg Conversation Partner Model, and the linking of that voice-processing system with the Morio image-processing system, were developed here. The university's computer science department with 19 professors can boast of as many as eight "AI professorships" alone—more than any other university. But it was not to be, and now the Hanseats are opening their own laboratory, which is why Walther von Hahn did not heed the call from Kaiserslautern.

It is not science Senator Ingo von Muench (FDP) who is at the political helm of this research establishment, but business Senator Wilhelm Rahlfs (FDP). The man who supports academia does not have the money, but the business promoter wants to conduct local politics and has DM 4 million ready for the new institute. Half of it is to be used to expand the laboratory, which is being built on the site of an old police barracks, and the other DM 2 million will be used to support projects at the AI laboratory. Hamburg-based companies which already participate in the AI laboratory are, among others, Philips, the Dr Neuhaus group and the Stollmann systems retailer. The focal point is application-oriented research. "This includes, among other things, AI tools, science representations, expert systems, image processing, natural speech systems and technology progress evaluation," according to an announcement by the business authority, which thus hardly fails to mention any current subject in AI research.

The laboratory is regionally oriented. Says Walther von Hahn: "We want to support the parties interested in us right on the spot." For example, if they have problems with their AI implementation they don't have to explain to an expert in Saarbruecken what they are seeing on the screen, but they ask us just to drop by. Presence on the spot, as the software companies have also experienced, is indispensable, despite the most modern means of communication." Furthermore, the scientists want to offer support in implementing AI.

The institute could benefit from a special Hamburg AI tradition: the "holistic approach" (from Greek holos = whole), as von Hahn calls it. "We prefer projects that transcend the field, such as the combination of speech and image processing. AI systems are not simply a machine which transforms a fixed category of problems into standing solutions," he further explains, " it is a supporting system, which must constantly be altered—for example a system to optimize alternatives for a company when circumstances change for the company. AI systems need to be nursed."

FRG Contributes Parallel Computer to Supercomputer

36980163c Leinfelden-Echterdingen EEE in German 14 Feb 89 p 66

[Text] The Rhine-Westphalian Institute of Technology in Aachen (RWTH) and IBM Germany Inc., Stuttgart, on Thursday concluded a cooperation agreement which will enable international research in the supercomputer field.

According to an announcement from IBM, the essential part of the cooperation is a superhigh-performance computer (model IBM 3090-600S with six vector installations), which RWTH and IBM will also use within the framework of the European Supercomputer Initiative (ESI) by IBM.

At the end of 1987 IBM created ESI in order to fund teaching and research in Europe in the field of supercomputing with about DM 72 million over the next few years. RWTH is the first German institute of higher learning to participate in research work for this initiative under the conditions of the cooperation agreement.

According to IBM, this will enable Aachen to undertake international supercomputing research projects in the

international network system, which includes European supercomputing research facilities in existence or under construction in Belgium, France, Italy, Switzerland and Sweden.

Finnish Parallel Processing Program FINSOFT III Examined

36980211 Helsinki FORUM FOR EKONIMI OCH TEKNIK in Swedish No 6, Apr 89 pp 52, 54

[Article by Svenolof Karlsson: "Next Computer Advance: Parallel Processing"; first paragraph is FORUM FOR EKONOMI OCH TEHNIK introduction]

[Text] The lack of a software export industry is a big problem in the Finnish computer branch, according to Ralph-Johan Back, professor of information processing at Abo Academy and the man with the scientific responsibility for FINSOFT III—a research program that concerns what appears to be the next big advance in computer technology: parallel processing.

Processors working in parallel are very big on the world scene just now. A boom is under way and Ralph-Johan Back and his colleagues, who have been involved in research on the subject for several years now, are doing a good job of keeping up.

Back's ace in the hole is called Hathi 2, a computer with 100 processors (of the T800 type) and 25 control processors whose performance equals that of a supercomputer: 1 billion commands, corresponding to around 150 million floating-point operations a second. One of the differences is the price. While a supercomputer is in the 50 million mark class, the hardware for Hathi 2 costs around half a million.

"The idea is based on connecting a number of microprocessors, which are mass produced and thus inexpensive, so that they work in parallel," Back notes.

In the language of the human workplace, one could say that through teamwork, cooperation, the processors can work together to handle more difficult problems than they could manage individually. The prerequisite is that the division of labor works. A suitable task should be delegated to each processor.

This requires a computer programming method that is entirely different from the one now in use, but when it comes to hardware there is no obstacle to making big versions of Hathi, according to Back. A computer with a thousand processors working in parallel can be built using the same design, for example.

Thus the weakness of parallel processing so far lies in the software. The algorithms must be divided in such a way that there is a program for each processor. Then it is a question of getting the processors to communicate, preferably so well that the process is a hundred times faster. "The speed depends on the type of problem. Hathi 2 does not handle certain problems as well as a supercomputer, but it handles other problems better," says Back.

Examples of things Hathi does well are "computer vision," pattern recognition, computer graphics, picture handling and simulating scientific problems. Parallel processing also has big advantages when it comes to making rapid checks on situation changes and reacting to them quickly, for example in the case of robots that must be able to go without losing their balance and cranes that must be able to operate without making the cable swing.

Computers with properties similar to those of Hathi 2 are starting to turn up in other countries—although it does well in an international comparison.

"One of its biggest advantages is that one can obtain so much information about what is really happening in parallel processing," says Ralph-Johan Back.

He points out that Hathi 2 is a scientific prototype and that it would look different if it had been produced for commercial purposes.

"Hathi lacks things regular computer users want. On the other hand Hathi is designed in such a way that these functions can also be included," Back says.

Hathi 2 is a year old. It acquired its physical shape at the State Technical Research Center's computer technology laboratory in Uleaborg last March and was then installed at Abo Academy's institute for information processing in Abo's Data City.

Hathi

The Hathi project, financed by TEKES [expansion unknown] and the Finnish Academy, among others, was completed at the end of last year. Its main task was to introduce so-called massive parallelism in Finland. In addition to developing this technology generally, the possibility of monitoring the operation of the processors was explored and theoretical methods were sought for designing parallel programs.

Other things stressed in the project were the possibility of illustrating the execution of parallel programs graphically and the application of these programs in more practical contexts. Here work was carried out in cooperation with the State Technical Research Center VTT [expansion unknown] on processing satellite data, Jyvaskyla University's nuclear physicists on various accelerator experiments and Abo Academy's chemical engineering faculty on simulating what goes on inside a blast furnace.

Hathi 2 is now connected to the computer network and can be used by all Finnish colleges.

The Hathi project has acquired a sequel in FINSOFT III, a special sector of the big 3-year research project on computers that started at the beginning of the year with TEKES providing the major financing.

FINSOFT

Part I of FINSOFT involves research on office automation, data bases and company data structure. Part II involves embedded systems, computer systems that are built into various products, such as washing machines, cars and industrial robots. Part III involves parallel calculations (eight subprojects) and neutral networks (four subprojects).

Thus Ralph-Johan Back bears the scientific responsibility for FINSOFT III. The administrative head of the project is research director Atte Kortekangas of VTT. The budget for the 3 years is 18 million marks.

The subprojects are spread out around the country in Helsinki, Tammerfors, Villmanstrand, Jyvaskyla, Uleaborg and Abo. The two largest, Millipede and Centipede, are being worked on at Abo Academy's institute for information processing under Back's leadership.

The aim of Millipede is to make it as simple as possible to write multiprocessor programs—which requires the ability to monitor them closely when they are used, among other things. The aim is also to come up with a simple "interface"; the user will not need to know so much about the hardware.

According to Back the problems can be compared with those faced by a traffic planner.

"In a city, people move from one place to another all the time by car, bus or other means. If the city plan is poor, bottlenecks occur. Everyone wants to cross the same Aura Abro bridge at the same time.

"Similar problems are found in multiprocessor systems. It is necessary to be able to keep an eye on what is going on in about the same way as if one sat in a police helicopter above the traffic control officers. These matters are quite involved," Back says.

Several companies, Wallac, Instrumentarium, Envic and Diacon, are cooperating with Millipede. Instrumentarium has already been able to utilize the results in cameras with medical applications.

Centipede

The Centipede project is aimed at creating better methods for designing programs.

"There is a central problem in the background, the poor quality of software, the difficulty of getting programs that work 100 percent, without bugs," Back says.

The difficulties are obvious. It can take years to build up good programs for some industrial application, for example. If there are errors in a program that is etched into a chip the consequences can be catastrophic.

Centipede is aimed at formal mathematical methods. The goal is to be able to design programs that describe each step and show that they are functioning as intended.

"It is impossible to take a big program and prove that it is designed correctly. But it is possible to solve the problem by breaking it down into different parts and expanding it piece by piece (stepwise refinement)."

As a step in the Centipede project they constructed a computer-based environment that includes an advanced editor that checks to see if the solutions in the program are working. A secondary effect was the development of a new programming language for parallel programs. The nature of the Centipede work requires a long-term effort. Intensive research in the area is being carried out around the world and some kind of breakthrough can be expected soon, according to Back. His research group has been well represented at international conferences with many published reports. Millipede is a more daring effort, with no real research tradition.

Finland's Problem

Finland is far advanced in several areas of computer technology research. But industrial readiness to utilize research results is weak. Despite the fact that salable items exist Finnish companies are often completely uninterested. On the other hand the researchers get offers from other countries, according to Ralph-Johan Back.

"In Finland people are more inclined to import things than to export them, especially in the software area where we have hardly any companies at all."

Back himself explains this lack: software production calls for expensive human labor, it takes time and requires risk capital. The domestic market is too small, they ought to turn directly to the European market.

But the biggest problem is something else:

"Too few competent computer people are working for Finnish firms. Those who do are absorbed in routine tasks and do not have time to develop new products."

But a good selection of capable computer people does not exist outside the business sector either. It is also hard to find competent candidates in the academic world. Businesses have contributed to this by recruiting students before they graduate. The consequences are serious at his own institute at Abo Academy. Like himself, a great many of the staff members are on leave to work on research assignments. The substitutes seldom have the prescribed formal competence.

"A reassessment may have begun now. When people started worrying about European integration efforts they noted that computer knowledge would be in greater demand," says Ralph-Johan Back.

UK Operating System for Transputer-Based Computers Discussed

36980199 Sundbyberg DATORNYTT in Swedish 27 May 89 pp. 18- 20

[Article by M. Brown: "Helios Distributes Transputer-Power"]

[Text] The Atari Transputer Workstation is one of the transputer- based computers that has received a lot of attention. According to Atari, eight such workstations in a network have the same computing power as a supercomputer, but at a cost of £150,000 compared to £ 10 million, respectively.

Perihelion from Cambridge in the UK has built the workstation and its distributed operating system. They succeeded in capturing Atari's interest when no other British company wanted to gamble on transputers.

Perihelion Software is run by Tim King, an academician with a degree from Cambridge University. Before King took over Perihelion, he worked for Metacomco, which at that time consisted of three people working over a garage in Bristol. During his time at Metacomco, King wrote the main part of AmigaDOS for Commodore, before he started to look for projects that could satisfy his interest in the RISC technique.

RISC-Chip

He knew Jack Lang, founder of Perihelion Hardware, and became interested in his ideas about a graphic workstation based on the RISC- chip. They chose three candidates for the main processor of their new machine: Fairchild's Clipper, Acorn's ARM and Inmos's transputer. In the beginning, they were not fascinated by the parallel architecture, but rather by the chip's RISC features. As Acorn already had begun to manufacture ARM for its own use, they decided to concentrate on the Inmos chip and began to look for capital to finance the project.

King explains that Perihelion is using several different methods to develop Helios. There are a multitude of transputers in a number of configurations, from cards in personal computers through options in Atari ST to development machines, and all have been coupled together via a network to a large Unix-based minicomputer.

He praises Richard Miller who has constructed the gate arrays for Cambridge Computer Z88 and Nick Garnett who has constructed the main part of the Helios nucleus.

Message-based

Atari is an important customer for Helios, but there are several others, including an Inmos-spin-off, Meiko, which wants to use Helios in its graphic supercomputer Computing Surface, and Commodore, which is planning to use the system for its transputer-based option to Amiga.

Helios is a completely distributed message-sending operating system, the nucleus of which is spread over several processors. Every processor can thus direct a full set-up of I/O units in the form of picture screens and discs. In practice, instead of loading all processors with such programs, some will be reserved exclusively for computational tasks.

King explains that the purpose of Helios is that worskstations can be connected in such a way that the processors in all machines would in practice be available for all users. The hardware for the network is said to be simple and consists in principle of serial links that work with up to 20 Mbit/s. It does not require any extra chips because the transputer already has the necessary communications functions.

Shell Like Unix

King points out that every person will have access to his own transputer at his own workstation. And when other users log off to go for lunch or at the end of the day, the hardworking person who stays may utilize all transputers in the other workstations to speed up his software.

There may also be a large unit of transputers, Meiko Computing Surface, for example, connected to a network, and this unit can be shared by all users in the same way that printers are usually shared by several users.

It is interesting to note that Helios has been made to look like Unix as much as possible, because many workstation users, constructors and programmers, for example, are happy with Unix. The Helios shell looks exactly like Unix C and is made to accept all important Unix commands. Internally, however, it works quite differently from Unix. Perihelion has imitated calls in Unix version 7 so that many programs, especially development tools can be transferred without much more work than recompiling.

MicroEMACS

For example, the ordinary editor MicroEMACS has been transferred to Abaq with the help of the available C source code. Therefore Perihelion writes a big part of Helios in C instead of Occam, the language written for transputers, and the rest in transputer- assembler. Perihelion has developed the C-compiler internally, but using the Norcroft-compiler as the point of departure.

King explains that every transputer in a Helios network must run at least one systems program which is called Nucleus and consists of about 30 KB of codes and uses about 100 KB of workspace. Nucleus is divided in modules called Kernel, Process Manager, Loader, and System Library.

Kernel handles all hardware resources in the transputer. The module takes care of sending the messages and sets memory space aside for various programs, both in the transputer's own memory and in external memory. In Kernel, there is also a routine called Name Server that is responsible for handling lists and for signal tasks.

Resident Modules

Processor Manager creates new programs, controls them, finishes them and frees their resources. One program will be taken care of by one or more transputers. A Helios program also requires extra resources in the form of open files, static memory areas and dynamic memories - and these reources belong to the program and not to its entrance processes. Occam processes on the other hand are completely static entities in which the entire memory is divided at the loading. Helios does not have to admit processes in the Unix sense because they are created and handled by the hardware in the transputer.

Loader is intended for loading objects in the processor when needed and unloading them when they are no longer needed. The module translates program pictures and puts them in the right place in the memory, loads resident modules and handles passive data objects such as fonts and other picture elements. Resident code modules represent the programmer's interface with Helios. They are to some extent comparable with the configuratable unit routines in DOS but they can cover more than one program.

Helios System Library is a resident module that is responsible for that which are system calls in an ordinary operating system. All applications must "speak" with the machine through this module. System Library keeps track of the resources that have been assigned to the ongoing programs so that they can be freed when the program is finished. All languages that use the same link construct can call its routines directly. A table with a pointer to the program resources is the first extra parameter that is required in all system calls.

Code Economy

The division of resident modules results in better code economy. The commands for listing catalogues, for example, takes 663 bytes in Helios, but about 11 KB in Unix. An alternative systems library offers Unix-compatible system calls, which limits potential compatibility problems to one single module.

King explains that Helios programs only need to communicate with each other through messages. Single processes within a program can communicate in an elective way, through division of memory space or through "raw" transputer links, for example.

The construction of Helios is based on a "client/server" model with many similarities with the one in Amiga-DOS/Tripos, which is not surprising considering that both systems originate from the Cambridge Dsitributed Operating System developed for the network Cambridge Ring. Applications request help from the system service programs by sending messages to them.

Helios can run system service programs anywhere in the network and they are completely transparent to the user and the applications. This was achieved by the nucleus "Name Server" that can search through the network to locate other service centers.

Own Algorithm

All service centers in Helios are named objects in the same way as files are in an ordinary operating system. Therefore, a listing command produces a list containing both service programs and files. And the same command with any service name as a parameter will show the contents of the service center.

The memory center in Helios is a file catalogue. For other central service types, a list of actual programs is available. If one types a listing command followed by a catalogue name for a disc belonging to another workstation in the network and one has authority to use this catalogue, its contents will be listed. The Name Server module searches through the whole network to find a service center with the given name.

Until one logs off, the name of a current catalogue will be listed at one's own workstation because the Name Server now knows where the catalogue is. The Name Server uses a special search algorithm (it resembles the well-known fill flow in graphics) to be independent of the network.

Repetition Until Success

King also explains why Helios service centers are "status-free". Namely, a request's success is never dependent on the previous request's success. The result is duplication of information to some extent, since the service center is not allowed to store any history (every read or type write request for a file must be accompanied by a file name again), but a positive result is that the system thus becomes very tolerant of errors.

Every request can be repeated until it succeeds, unlike in DOS where one gets an error message if a file cannot be read.

Message sending in Helios must have the capacity to forward messages between programs on separate processors as well as between programs on the same processor. Messages are sent to program units called "message ports" and not directly to the programs.

Surrogate Port

A "surrogate port" in the sender processor to which a message is first sent represents a message port in a remote processor. A surrogate port has the exact form of a real port, but it contains the address for a physical transputer link which carries the message to a port in the adjacent transputer which can also be a surrogate port.

The message is carried in such a way from transputer to transputer until it finally reaches its real destination. The message leaves a "trace" of port descriptors in each processor it passes which leads back to the origin of the message. Normally the surrogate ports close after the message has been received in the right way, which saves memory, but a flag in the message head can be set up to save the ports so that the road remains open for future messages.

If a message cannot be delivered due to a machine or program error, an exception message will be generated and sent back along the route to the sender who can then try again. If the exception message does not reach its destination, a time function will be released at one of the ports so that an error message will be generated in that processor.

"No News Is Good News"

Messages are not acknowledged mechanically as in more conventional handshake protocols. Instead it is assumed that no news is good news. Therefore, corrective action is required only when an error has really occurred which eliminates the permanent extra work.

Since there is no hardware memory protection, Helios introduces a program memory protection based on "functions." This protection functions for everything from protecting data objects against accidental influences to limiting access to files.

A function is composed of a 64 bit data structure containing two fields, one 8-bit access mask and one 56-bit control string with a known control value coded together with the access mask. Whenever a new object is created in Helios, the system assigns the object a unique code key that is stored with it for the rest of its life. The object uses this key to combine the creator's access mask with the control string, after which it gives the coded function back to the creator. A customer program can reach an object only by presenting the correct function with the necessary access authorization, in about the same way as one shows a credit card to a sales clerk. The object uses its stored key to decode the customer's control string.

A correct control value validates a function. An incorrect value is either forged or misrepresented. After the control has been approved the object separates the coded mask bits and builds an OCH function between them and the secret code field, whereby the result indicates which authorization the user has. One can compare this first step to a control of a hologram on a credit card to determine its validity, and the second step to a control that sees if there is money in the account.

The service center reads the eight authorization bits. Most objects have a Delete bit and an Alter bit to indicate how the user can erase or change them. The file object has Read, Write and Execute bits in the same way as in Unix. Processors are also objects and when a user is given a new processor he or she will be offered the capacity to execute programs with it while excluding other users. Programs cannot be finished, cancelled, or interrupted without a valid function.

Most of the functions are transient magnitudes residing in memory only as long as the program lasts. File system functions are long-lasting and can be stored on disk or written into programs. Whenever a user logs on, he receives a function for his own catalogue which in turn contains functions for the objects that he is authorized to use.

King continues to explain how programs can be distributed within a Helios system simply by dividing the whole program onto different processors. In this, Helios departs from the parallel principle applied by Occam. A genuine Occam program can have many parallel processes on various transputers, which makes it possible to manage parallel algorithms with maximum efficiency. Such programs are very fine-tuned because they contain so many small components.

"Helios-technique still admits three lower parallel levels", King continues.

Three Parallel Levels

The first level is a Unix-like method by which small single function programs, such as Helios-commands, file filters, or editors, and compilers are coupled together. A Helios-routine called Task Force Manager assigns each such complete program to a separate processor and transputer links take care of the connections. The processors can either be located in the user's own cluster or they can be formed of other processors or assigned from a joint group only during the execution.

Frequently used programs, compilers, for example, can be placed permanently on a certain processor so that all calls for the program can be made directly to that processor. As the program is stationary, several users can share this processor.

"Otherwise, Helios will never allow different users' programs to share the same processor," King says.

The second parallel level is used for bigger programs that are divided in separate modules which can be divided between various processors. It is often easy to carry out this division, because many large Unix- programs are already built as a number of overlays to be used by virtual memories on disk. An application will require a raw file which describes the composite parts of the application, their memory requirements, relative placement, connections to other modules, etc. Task Force Manager uses this file for the placement of components and for the execution of the task.

Occam Compatibility

The highest parallel level is the one that entails Occam compatibility. Helios can take the components in an Occam construct, a group of parallel processes and build a raw file for them after which each component is assigned a separate processor. Each component must be formed like a complete program by wrapping it up in a cocoon of extra processes that are compatible with Helios system functions.

King adds that besides the mentioned C-compiler Perihelion has created a transputer assembler and a link function, and is working on a debugger which will allow a transputer to monitor the activity of another one and which would have characteristics normally found only in hardware debuggers. One can note further that other companies are working on Pascal-, Fortran-, Lisp-, and BCPL-compilers, like a Helios- based Occam-compiler.

X Windows

Graphic support in Helios is achieved by the help of X Windows, a window manager that has been adopted by many of the big manufacturers like Apollo and Hewlett-Packard.

Perihelion's X Windows function so that all graphic operations are carried out by sending messages to a graphic server that can contain running routines for ordinary graphic hardware. X Windows will also be used for introducing a WIMP interface as an alternative to the C-shell.

King explains that Helios is an operating system for more than one computer and that Perihelion has an IBM PC-version that can work with transputer cards of the same type as Inmos B004. Each PC runs a Helios- server under DOS while Helios itself is run on transputer network.

King describes Helios a "really distributed operating system." Namely, there are no central functions that the entire system depends on. This increases reliability since an error in a processor or in a part of the net does not entail that other parts stop working (although their capacity to function may decrease somewhat). Helios's distributed nature is transparent to the user as well as for the programs in the system. They do not ever need to know exactly where various functions come from. This distinguishes Helios from network operating systems with a different kind of distributed nature.

Technical Description of Helios

Helios is an operating system that has been constructed for transputer architecture and at the same time to be familiar to the users of Unix. Transputer hardware consists of many functions otherwise contained in system programs, e.g., process development, process recoupling, time allotment, and message sending between processes. Helios uses these primitives as building blocks for an operating system that can be used for a multiprocess system.

Helios is a truly distributed operating system. Namely, there are no central functions upon which the whole system is dependent. This increases reliability since an error in a processor or in a part of the net does not entail that other parts stop working (although their capacity to function may decrease somewhat). Helios' distributed nature is transparent for the user as well as for the programs in the system. They do not ever need to know exactly where various functions come from. This distinguishes Helios from network operating systems with a different kind of distributed nature.

Helios has an open architecture where parts can be added, removed, modified, or exchanged for various purposes. To some extent, Helios is simply a collection of concepts, or rules, of behavior in programs. It can be viewed as a "program base" responsible for the infrastructure that allows processes to find and communicate with each other.

Helios introduces a low level boundary cut familiar to programmers who have worked with Unix. Every user runs a number of programs that can communicate with each other with the help of a simple protocol for broadcasting messages. A message can be transferred between two programs in the same machine or between programs in different processors. The call is exactly the same in both cases and the message is copied rather than forwarded in the form of a reference.

Helios's operation is based on a "client/server"- model in which applications request help from system servive programs (server programs). These programs can be found in one or all available processors, but every processor must run at least the routine Name Server which indicates the location of other routines. The rest of the service routines contain file managers, window managers, data managers, spool functions, etc. All service programs work according to a general server protocol which is built so that the service programs can be status-free and thus unaffected by hardware faults and communication breaks. This mechanism admits a wide choice of functions, e.g., a DOS format is used for floppy disks while hard disks use a Unix-like format.

A sophisticated protection system is built with the help of functions. This is used to protect processors against unauthorized use (each processor is assigned to a single user) and to control access to the file system.

DEFENSE INDUSTRIES

Defense Research Institute (FOA) Discussed

Swedish Author Interviewed

36980198b Stockholm NY TEKNIK in Swedish 27 Apr 89 p 30

[Interview with Wilhelm Agrell by Erland Rost: "Wilhelm Agrell: Defense Research Institute Passive"]

[Text] The Defense Research Institute, FOA, is an organization that has lost its assignment and found it difficult to find a new role, so argues Wilhelm Agrell, a researcher, who recently wrote a book about the role of research in the Swedish defense forces.

Sven Hellman, who is president of the Swedish Engineers Against Nuclear Weapons and who works in the Defense Department, will review the book below.

"As I see it," says Wilhelm Agrell, "the problem with FOA is that this institution is built as a governmental department rather than being organized like a university or college."

"The departmental structure makes it almost impossible to come to grips with long-term and overlapping research policy problems. The same problem exists internationally: An institute will be set up for defense research and for a definite purpose, but cannot keep up with rapidly changing conditions."

Wilhelm Agrell points out that FOA was created for only one purpose: To develop new conventional weapons after Wold War II. In the 1950's and 60's, nuclear weapons research became the backbone of FOA. In those days, the defense budgets were relatively larger and there was a yearly percent increase on top of the predicted amount for the "technology price increase" due to inflation.

Swedish nuclear disarmament revoked FOA's main task and created a problem of safeguarding the competence of nearly 1,500 men in some sensible way. From 1969 to 1972, the so-called Engstrom's report (a defense research report) outlined a plan to break up FOA into independent research institutes in accordance with a research council model which functions well in the civilian academic world. The proposal was torpedoed for budgetary and other reasons, and the end result was that FOA remained in its original form; however, there was some decentralization.

Wilhelm Agrell believes that a lot of the passivity that now is characteristic of FOA could have been avoided if the report's proposal had been carried out.

"I don't mean this to be a sweeping criticism of all of FOA. There is very high competence in certain areas which function well."

In one specific area, FOA seems to have pulled itself together and tried to be a coordinating force: protection against submarines. Despite the fact that there have been more or less well-documented violations, there were no major coordinated measures earlier in this area. The Navy has used its low budget appropriations mostly to buy new ships.

Protection against submarines is a multi-disciplinary, complicated task with connections to industry. A niche for FOA—In this case, the military is surely interested, although this interest is not always obvious. Wilhelm Agrell thinks that it will be very interesting to see how the submarine venture turns out.

Regarding the military research interest, there is a difference between now and then. The author thinks that the military was much more open to new weapons in 1950's. Today the opinions are more conservative. They would rather develop proven technology than venture into new areas. That depends naturally on the shrinking appropriations, but also on the fact that before it was the military leadership led by the Chief of Staff who decided about new technological ventures.

Today, the defense branch chiefs have much more influence. They hold very conservative views and rightly do not have the same overview of the defense policy that the Chief of Staff and his staff have.

Book Review: "Military Research Lost Its Assignment"

36980198b Stockholm NY TEKNIK in Swedish 27 Apr 89 p 30

[Book review by Sven Hellman: "Military Research Lost Its Assignment"]

[Text] Can the Swedish defense research industry develop new vital technological changes in the world in time and contribute to necessary adjustments in the Swedish defense?

The Defense Research Institute (FOA) with its departmental structure is scarcely able to meet the demands for quick and extensive changes in priorities. A less tight institutional organization with ties to researchers at universities and technology institutes emerge as more appropriate.

Researcher Wilhelm Agrell draws these conclusions in a recently published book "Science in the Service of

Defense: New Weapons, Defense Research, and the Battle Over the Structure of Swedish Defense," Lund University Press, 1989.

The book is a result of the venture on the theme of research policy, military technology, and national security at the Research Policy Institute at the University of Lund.

In his book, Agrell gives a wide and interesting survey of the Swedish defense research's beginning before and during World War II, institutionalization with the formation of FOA in 1945, the big investment on the issue of nuclear weapons, the many political reports in late 1960's and early 1970's, and finally the current situation. He brings out the developments through international comparisons.

Swedish defense research arose in a short time from exceptional external and internal conditions. It grew because the users, the defense forces, the industry and various emergency troops wanted it, and because technicians and scientists who saw possible military applications in their areas of operation pressed for it.

From the international point of view, the Swedish plan of creating a joint institute for all defense research was unique. According to Agrell it had its basis in the defense forces' desire to gain control over technological development and applications.

Operations analysis, popular in England during World War II, progressed even in Sweden. It represented a revolution in the way that military operations were led. For the first time, scientists were allowed in on the innermost domains of the military - the military operational judgments and decisions - and given a lot of influence there.

But Agrell does not find any support for the thesis that defense research institutes and their staff are a driving force in the arms race and that measures should be established to limit the research. The researchers simply have not been sufficiently influential.

The big exception in Sweden, according to him, is the nuclear weapons program which, if it had been carried out, would have created a tightly united collective of researchers with a decisive influence on the development of defense.

With the political developments in 1968-73, including a definitive "no" to Swedish nuclear arms, a more restrained military budget development, strong pressures for rationalization, and a new planning system stressing the government's leading role, the Swedish defense research lost much of its earlier support both from the military and political side.

The decision to keep FOA, despite this and with only minor cuts, but at the same time to deny the idea of the central role for defense research in defense planning created a situation which Agrell characterizes as "defense research without an assignment." An organization that had lost its original main task and failed to establish a new one came up against an identity crisis.

The real power factor in the defense development is industry, he thinks. Both the defense forces' representatives and the politicians constantly underline the value of domestic defense industry. The need to maintain competence and production capacity has since the 1960's become a central defense industry problem.

I am surprised that Agrell after all his studies got such a negative picture of the defense research. How can he talk about the task-less defense research and its bureaucratic inactivity after having seen the 1987 research policy proposal and the 1984 defense committee's deliberations?

He points to weaknesses in the united organization for defense research, but does not discuss any alternatives at all. He does not touch upon the cultural differences between scientists and military men which FOA with its close contacts with both camps bridges.

He does not deal even with the need for multi-disciplinary research and development projects that must be simpler to put together in a joint organization. But my overall impression is that Agrell has given an interesting picture of the beginning, rise, and policy significance of Swedish defense research.

FACTORY AUTOMATION, ROBOTICS

Growth of French CIM Market Examined

36980228c Paris ELECTRONIQUE ACTUALITES in French 14 Apr 89 p 4

[Article: "The French CIM [Computer-Integrated Manufacturing] Market Exceeded Fr21 Billion in 1988"]

[Text] In 1988, the French CIM market represented Fr21.2 billion, i.e. one tenth of the country's total industrial investments. Its growth, which exceeded 20 percent per year from 1981 to 1987, when France was underequipped, should remain above 10 percent per year until 1993. These data were provided by the BIPE [Economic Information and Forecasting Bureau]; it also indicated that the European market represented Fr140 billion in 1988, distributed about evenly between automata and industrial data processing on the one hand and automated machines on the other hand.

Two Major Product Categories

CIM is now a reality which plays an important part in the French economy. For instance, its consumption is equal to one half that of the pharmaceutical or aeronautical industries. The CIM market consists of two major

product categories. On the one hand, automata (programmable controllers, numeric controls, regulation, industrial local-area networks, peripherals and automata software) and industrial data processing (CAD, control/command data processing, computer-assisted production management), representing together a market of Fr12.5 billion. On the other hand, automated machines, with sales amounting to Fr8.7 billion.

15 Percent per Year for Robots

Since 1987, automata and industrial data processing sales have increased much faster than sales of automated machines. In 1988, software and services accounted for 38 percent (Fr4.754 billion) of the automata and industrial data processing market. As far as hardware is concerned, although computers account for one half of the sales (46.3 percent), industrial local-area networks (2.2 percent in 1988), the privileged tools of integration, will experience the strongest growth (over 30 percent per year) over the next 6 years. These trends reflect the efforts made by many users to integrate all CIM tools into a fully-automated and computer-controlled design and production setup. CIM, for a long time just a mere concept for the future, is now being implemented in factories.

The "mechanical" segment of the CIM market, i.e. automated machines, is dominated by numerical-control machine-tools (MOCN), accounting for 48.7 percent of 1988 sales, followed by automated handling equipment (25.3 percent), plastics machinery (18.4 percent) and robotics (7.6 percent). Nevertheless, the next few years will witness a slight decline of the MOCNs, the growth of which will slow down considerably, and an expansion of robots, estimated at 15 percent per year.

In 1986, 6 industrial sectors accounted for 60 percent of automata and industrial data processing sales in France. The leaders were the automobile sector (12.2 percent), chemicals and parachemicals (12.2 percent), and electrical and electronic engineering (11.2 percent); they were closely followed by oil and gas (9.2 percent), mechanical engineering (8.1 percent), and the agrifood industries (7.1 percent). By 1992, this breakdown of electronic CIM consumption should reflect essentially a strong increase in the demand from the electrical-electronic sector (to 14.2 percent) and a more moderate increase in the requirements of the mechanical engineering (9.2 percent) and agrifood (7.7 percent) sectors. The oil-gas sector alone would see its consumption decline in relative value (7.6 percent).

As for the demand for mechanical CIM equipment (automated machines), it is concentrated in 4 major sectors: mechanical engineering (18.6 percent in 1987), foundry and metalworking (16.1 percent), rubber and plastics (15.5 percent) and surface transportation equipment (15.1 percent).

France: Second Largest Market in Europe

With 15 percent of the European CIM market, France ranks second on the continent, way behind the FRG, and growth projections are slightly higher for our German neighbors than for most European countries. In this respect, only Italy and Spain could at least equal the FRG until 1993.

The world market is equivalent to three times the European market, and the United States, Japan and Europe are practically even. Other areas account for only one tenth of the world CIM consumption. Similar growth (12 to 13 percent per year) is expected to take place in all continents.

MICROELECTRONICS

FRG Researchers Develop High-Speed Silicon Transistors

36980163b Stuttgart VDI NACHRICHTEN in German 17 Feb 89 p 18

[Text] In the worldwide race for higher operating speed for data processing and transmission facilities, engineers in Bochum have succeeded in proving that it is still clearly possible further to develop the proven and cheap semiconductor material silicon. With their development of a superfast bipolar transistor based on silicon, Prof Berthold Bosch and Dr Hans-Ulrich Schreiber will penetrate into regions of speed on the other side of the 10 Gbit/s "sound barrier", which until now had not been thought possible to reach with silicon chips. Researchers from the Department for Electrical Technology and Microelectronics Center at Ruhr University in Bochum did their work in cooperation with colleagues from the AEG Research Institute in Ulm, which is the leading firm in the manufacture of the kind of chips needed for semiconductor heterolayers.

The cheap silicon material is still the "work horse" of chip manufacture, to be sure, but many researchers think that they have already reached its maximum working speed of about 10 Gbit/s. For this reason, in the last few years the use of compound semiconductors have already been favored and researched in many places. The next computer generations are to be equipped with these complicated and expensive semiconductors based on gallium arsenide.

The fact that speeds of 20 to 30 Gbit/s can also be reached with silicon (Si), however, could be proved with the first "genuine" Si/SiGe hetero-bipolar transistor (HBT). The Bochum scientists achieve this by the introduction of about 10 to 20 percent of the elementary semiconductor Germanium (Ge) in a certain layer, only 50 nm to 100 nm-"thick."

Indeed, both IBM, NEC, Bell Laboratories and Stanford University (California) are today working on silicon bipolar transistors with a SiGe base region, but they have

not yet reached as acceptable a current amplification as the Ruhr University, with values up to 800. The German scientists used an optimal "doping concentration" (introduction of foreign substance concentration), which is considerably higher in the base region of the transistor than in its emitter region. And that is what makes a "genuine" HBT.

In their next steps the Bochum and Ulm researchers will continue to optimize transistors, shift to self-adjusting manufacturing processes, describe the parameters more accurately and finally produce the first simple integrated circuits (IC's). At the Ruhr University one is confident that, with these new heterostructure silicon transistors, circuits can be built with bit rates so high that they appeared unattainable until now.

NUCLEAR ENGINEERING

Finland Considers Expansion of Nuclear Power Plants

51002423 Stockholm NY TEKNIK in Swedish 27 Apr 89 p 10

[Article by T. Backmansson: "Finland Interested in Swedish Nuclear Power"]

[Text] Finland may buy a new nuclear power plant from ABB Atom; the decision is still two years off. The Finnish government is not expected to decide on the future of nuclear power before the national elections in 1991. No new nuclear power plants will be built or ordered while the present coalition government is in power. The administration made this decision under public pressure after the Chernobyl disaster. After the national elections in 1991, the new government will be free to decide whether or not to expand nuclear power.

Klaus Raninen, speaker for the board of the state power company, Imatran Voima, says that nuclear power is "on hold" in Finland.

The power company keeps up to date with the development of the Swedish boiling water reactor and the Soviet pressured water reactors. The Finns also follow developments in West Germany and France.

According to Klaus Raninen, Finland will have to choose between reactor manufacturers from these two countries. This opinion is shared by Magnus von Bonsdorff, VD at the Industry's Power, the company that runs the two Asea reactors in Olkiluoto.

"We have not decided to buy a new power plant from ABB, not yet. But we remain prepared to do so," he says.

Magnus von Bonsdorff does not favor ABB over other possible suppliers, but he says that it is important that ABB's expertise in nuclear power not be wasted.

"This know-how is a valuable asset, and as I see it, of a multinational common interest," he emphasizes. He adds that the prospects for expansion of nuclear power have become considerably better.

Opinions Change

The fact that the government easily granted a 10-year extension of the lease for the operation of the country's four nuclear reactors is the first concrete result of a change of opinion in Finland.

Finnish electric power consumption is expected to increase by about three percent per year until the mid 1990's. The increase will be met with a new 500 megawatt coal plant in Pori, some municipal heating plants, and larger imports of electricity from Norway and the Soviet Union. Toward the end of the 1990's, additional expansion will be needed.

"We do not know yet whether it will be coal, nuclear, or some other kind of energy," says Taisto Turunen, director of the Energy Department at the Ministry of Trade and Energy.

People in the ministry and the power companies agree that Finland can take care of its electric power consumption without nuclear power until the end of the 90's, and that a decision regarding expansion can wait until 1991.

Greater Energy Demands

Director Pentti Sierila at the Forest Industry's Central Confederation, however, does not agree. He thinks that the decision about expanding should already have been made.

"The Forest Industry's decisions to build new paper machines and to increase production of mechanical pulp entail higher energy demand, and inexpensive energy is the basis for maintaining profitability."

Today, the industry pays 15 pennies (25 Swedish ore) per kWh, which is about the same as in Sweden.

In recent years, the importation of natural gas from the Soviet Union has become increasingly significant for Finnish energy supply. The forest industry in eastern Finland and the petrochemical industry are major consumers. The high price and the somewhat uncertain supply, however, are slowing growth.

Considering the other energy sources, hydropower is fully utilized. The rivers that are not being exploited are protected. To an ever larger extent, water power has assumed the role of a regulating power plant, meeting peak demand needs. Peat is used mostly by municipal heating plants, and there is no significant increase in sight. [Boxed item, p 10]

Finnish Reactors Operate Efficiently

Finland has two reactors, Loviisa of Soviet manufacture and Olkiluoto of Swedish manufacture.

Loviisa has two 465 MW pressurized water reactors. Olkiluoto has two 735 MW boiling water reactors. Today Finland has the total capacity of 2400 MW.

The Finnish nuclear reactors have very high operating rates. To date in 1989, all of the reactors have been operating at over 100 percent capacity. [End boxed item]

SCIENCE & TECHNOLOGY POLICY

FRG: 1989 Budget of Karlsruhe Nuclear Research Center

MI890188 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 27 Jan 89 pp 6-8

[Text] The 1989 Program Budget presents the Karlsruhe Nuclear Research Center's new medium-term tasks and financial plan for the 1989-1992 period. The center's overall budget currently totals some DM737 million. This also includes continuing financing for Karlsruhe's share of joint projects such as the Laue-Langevin Institute in Grenoble, and for project management costs and special funding needs which altogether total DM94 million. After deducting the center's own revenues of about DM124 million, this leaves government subsidies to the center of DM613 million.

The current program budget perpetuates changes in the center's operational structure that have been introduced since the beginning of this decade. Individual areas of operational emphasis are broken down as follows:

Practical fast-breeder technology continues to be a goal of the FRG's research policy. The technical feasibility of the fast breeder and the resulting savings of uranium have been proven scientifically. Its approval and political acceptability in the FRG, however, is still in question. Further wide-scale development work is necessary to close the fuel cycle. A major area of emphasis in Karlsruhe's current program is safety research, which focuses on both the removal of unused heat by natural convection and on the complex issue of nuclear fusion waste. This work is intended for large fast-breeder reactors, especially the corresponding European Community project. Combustion rod and materials research is being reduced and partially turned over to industry. Such research is particularly important for the efficiency of the breeder reactor.

Reconditioning burned-out combustion rods is a basic element of the German supply concept and cannot be ignored in the fast breeder reactor's fuel cycle. The reconditioning and waste treatment project will therefore continue to have a high priority in the future, especially since Karlsruhe is the only place in the FRG where such comprehensive research and development work is conducted. Work on advanced fuels will increase in the coming years. The development and testing of electrolytic procedures to simplify processes and reduce waste will also remain very important for reconditioning in the future. An important goal has been reached in the field of waste treatment with the completion of the PAMELA facilities for glazing highly active waste solutions in Mol, Belgium. Improving the process and increasing product control are in the forefront at Mol.

Regardless of whether reconditioning or direct final storage of the combustion rods is chosen as the disposal concept, the need for final storage of radioactive wastes remains crucial. Karlsruhe's waste operations are coordinated with the Radiation and Environmental Research Company in Neuherberg. For its part, Karlsruhe Center focuses on the "related field" of the ultimate storage containers containing the product, packaging, and buffer material which includes the mutual reaction with the adjacent storage medium. Emphasis is placed on testing the safety of final storage areas.

The development of the separation-jet process for enriching uranium 235 has been technically completed. Ongoing activities that will be finished by the end of 1989 essentially involve the completion of remaining contractual obligations to Brazil.

The Nuclear Fusion Project gathers together work being done on fusion with magnetic containment. The project concentrates on the technical problems of this type of reactor. In particular, this includes the physics and technology of the so-called blanket in which fusion energy is transformed into heat and where the nuclear fuel tritium is bred. The project examines the acceptability of such installations, the choice of radiation-resistance materials, and the question of how to handle radioactive materials created in nuclear fusion, especially the nuclear fuel tritium. The center not only has comprehensive skills in all of these fields, but also works in specialized fields such as constructing superconductor magnets and developing heating technology for plasma. An agreement has thus been reached with the Ministry for Research and Technology that assigns all development of fusion reactor technology in the FRG to the Karlsruhe Nuclear research Center.

Close coordination between developments in technical and plasma physics has been ensured by the creation of a development team that includes the Max Planck Institute for Plasma Physics in Garching.

All European work on nuclear fusion is coordinated by Euratom. Thus Karlsruhe has signed an association agreement with the European Community that provides access to the European fusion technology program.

There are two aspects to the major emphasis placed on environment and safety. The first is organized as the project entitled "Controlling Hazardous Materials in the

Environment." This project examines the effects of technology on mankind and on the natural environment. Procedures for dealing with environmental problems are also being developed for such purposes as waste treatment, reduction of hazardous-material emissions, preparation of drinking water, and treatment of waste water. Meanwhile, the behavior and spread of hazardous materials is being analyzed quantitatively and described with the latest computer models. Fundamental biological research focuses primarily on the effects of hazardous materials on genetic and cellular material. Karlsruhe's systems-analysis working groups are leaders in the technical assessment of environmental impact, as well as in risk analysis and the application of information systems to the environment.

The second aspect of the emphasis placed on environment and safety involves work on the safety of light water reactors. Until late 1986 these were organized by project because of the large-scale experiments that ran until that time. Currently, studies of the disposal of nuclear fusion waste and its consequences are being carried out as contributions to Phase B of the German risk study. Among other things, this includes the development of disturbance filters to reduce pressure in the reactor's safety containers.

The objective of the emphasis placed on solid-state and materials research is to develop materials for modern technology. At the moment, this primarily involves high-performance metals or compound materials such as superconductors, particularly the new high-temperature superconductors with liquid nitrogen cooling.

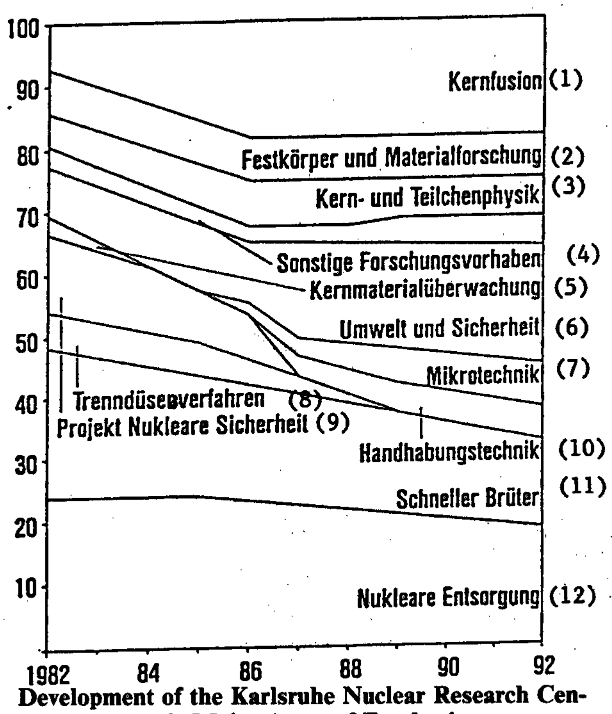
In the fields of nuclear and particle physics, the center uses its own major facilities, but also cooperates at the national and international level with technical universities and other research centers. In the forefront are two neutrino experiments which are currently being prepared with the Rutherford-Appleton Laboratory at its spallation source, within the framework of the international Gallex experiment in Italy. Meanwhile, testing is continuing to determine the feasibility of a high radiation experiment designed to completely identify the nature and origin of this high energy particle.

In past years two new areas of emphasis were initiated which originated out of nuclear technology and which hold great promise for applications in other areas of technology. The microtechnology emphasis focuses on developing the so-called LIGA [expansion not provided] process, a combination of X-ray photolithography, galvanics, and plastic casting procedures to mass produce three-dimensional microcomponents. In this case the R&D task consists primarily of producing mechanical elements and integrating them into electronic-mechanical systems using measurements derived from modern chip technology.

In the area of handling technology, methods are being developed for work in inaccessible or scarcely visible places or for work under difficult conditions. Available know-how in the disposal of nuclear materials and in data processing is being used. The objective is to have a balance of operator-controlled manipulations and program-controlled robot functions. Eventually, the operators of these systems should be assisted by advanced procedures and components such as sensor-aided environment measurements to prevent collisions or knowledge-based systems guidance.

Special mention should also be made of the successful technology-transfer operations to medium-scale and smaller industry which the Karlsruhe Center has been conducting over the last 10 years. Unlike the major projects in which entire technology packages are developed in close collaboration with industry according to research policy objectives, technology transfer is concerned with the industrial use of discoveries that were made in major projects, but which are not exploited. The technical emphasis given to technology transfer takes advantage of the center's broad range of knowledge and experience.

The following graph shows how the trends in the Karlsruhe Nuclear Research Center's major areas of emphasis are changing over time:



Development of the Karlsruhe Nuclear Research Center's Major Areas of Emphasis

Key: 1. Nuclear fusion—2. Solid-state and materials research—3. Nuclear and particle physics research—4. Other research projects—5. Nuclear material monitoring—6. Environment and safety—7. Microtechnology—8. Separation jet processes—9. Nuclear safety project—10. Operations technology—11. Fast breeders—12. Nuclear supply

The Karlsruhe Nuclear Research Center's program budget is available from the Nuclear Research Center Karlsruhe GmbH, 7500 Karlsruhe, Postfach 36 40, tel 07247-822861.

FRG: Subsidies Reduced in DFG's 1988 Final Budget

MI890195 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 21 Feb 89 pp 7-8

[Excerpt] Permanent harm is threatening research in universities, with particular detriment to the new generation of scientists. This is the verdict of the chairman of the German Research Association (DFG), Prof Hubert Markl, on the figures recently published in the DFG's annual report for 1988. These figures clearly indicate a dramatic deterioration in the research funding situation in the FRG. In a letter to the FRG chancellor and the ministers [Ministerpraesidenten], Markl has therefore called for a 6.5% increase in the DFG budget for the year 1990.

More young scientists than ever before want to obtain further qualifications after completing their studies, says the DFG chairman. "They have built on a level of research that has now attained a leading position in many fields. Breakthroughs in methods and equipment are opening up completely new areas of both pure knowledge and application. The opportunities that they hold out must be exploited now. They will not be repeated."

The demographic boom in young scientists is fully reflected in the number of applications, with the result that the gap between the total available funds and the sum available for each grant is growing wider all the time, Markl continues. The volume of applications for grants allocated by the normal procedure for priority programs and research groups thus increased by 13.7% in 1988. In the normal procedure, which is open to every individual applicant, only 48.4% of the funds applied for can now be provided—the lowest percentage since the DFG was established. This hits the humanities and social sciences especially hard, as they are particularly dependent on individual funding by the DFG.

The DFG's board of directors was able to accept only 14 of the 30 new applications for coordinated priority programs for funding in 1989. Nine more programs, which could not be faulted qualitatively, were rejected due to a lack of resources. At least 250 jobs for young scientists were lost as a result. Nevertheless, despite the increased teaching load, the readiness of university teachers to commit themselves to new generations of scientists in rigorously assessed, coordinated research programs is fortunately greater than ever.

Of approximately 40 initiatives currently introduced to establish new special research areas, about half are expected to be started by 1990 at the latest, says the DFG chairman. These are offset by only eight special research areas scheduled for completion and which therefore no longer require funds. Even though strict quality criteria are observed, the additional finances necessary for the special research areas alone will be at least 6-7% higher in 1990 than in 1989.

The DFG accurately forecast this trend in its medium-term financial plan, "Prospects for Research and Its Funding, 1987 to 1990" and announced a financial shortfall of 5% for 1988 and 5.5% for both 1989 and 1990.

In view of the increasing number of qualified research projects, the 3.3% increase rate for 1989 is insufficient and does not help to ease the situation, Markl points out. A significant growth in the DFG budget in coming years is urgently required, otherwise the FRG will fall behind in basic research. On the contrary, the DFG president urges in his appeal that future requirements should be met by seizing the chance to press ahead with basic research using the large number of highly qualified young scientists.

In his letter, Markl also mentions the much greater efforts made by other countries to promote pure research. In the United States the National Science Foundation's budget will increase by 10%, and the trend is the same in Japan. The British Research Council will have 16% more funds at its disposal in 1989, and basic research funding in France is increasing by 7.5%.

According to the DFG, the special DM2.1 billion program approved at the national and Land level to ease the teaching load on universities will be able to help in some particularly burdened subjects. However it will hardly be able to make a significant impact on the problem of university research. Those allocating state funds will therefore have to make a greater effort in the years to come to prevent the FRG from losing even more ground internationally as well. The large number of students in first-year undergraduate courses in recent years means that these same students are now reaching the postgraduate stages in increasing numbers. At least the more gifted among them should have the chance to obtain qualifications for professional positions by working on research projects. This will not be possible unless university funding is considerably increased. [Passage omitted]

FRG: BMFT Increases Subsidies for R&D in Berlin

MI890187 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 27 Jan 89 pp 3-4

[Text] Federal Research Minister Riesenhuber has stated in Bonn that the additional 10% preferential grant for industrial research projects carried out in Berlin will be extended for another 2 years effective 1 March. This contribution by the BMFT [FRG Ministry for Research

and Technology] compensates for unfavorable economic conditions in Berlin due to its geographic location. The grant to Berlin increases the BMFT share in industrial R&D projects by 10%. Subsidies are provided on the condition that either a major portion or all of the research project be carried out in Berlin.

Riesenhuber stated that Berlin's importance for German research has grown considerably as a result of several initiatives by the Berlin Senate and the intensive and increasing research support provided by the federal government. BMFT project support has more than doubled since 1982 (DM95 million at that time). The portion allotted to industry during that period also increased by 30%. Given the special structural difficulties of Berlin's economy, this share is still relatively small compared to the overall BMFT subsidies granted by this project.

By awarding institutional grants to a number of extra-university research institutes in Berlin, the federal government has long contributed toward establishing new economic prospects through research and development. These institutes include the Hahn Meitner Institute, research institutes of the Max Planck Society, the Scientific Center for Social Research in Berlin, the Heinrich Hertz Institute, and the Fraunhofer Society's Institute for Production Plants and Civil Engineering. Industry can therefore avail itself of research facilities recognized worldwide.

The Senate actively promotes closer cooperation between industry and science in some high technology areas by establishing "affiliate institutes" at universities. According to Riesenhuber, it is necessary to make better use of the outstanding facilities in Berlin, with all its research institutes that identify the city as a scientific center of international standing.

The extension of the preferential grant to Berlin will enhance the cooperation between science and industry. The Senate of Berlin is supporting this cooperation with economic policy measures such as grants to those involved in the innovation process.

SUPERCONDUCTIVITY

FRG: New Record Established at Juelich

MI890190 Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German 27 Jan 89 p 10

[Excerpts] Scientists at the Juelich Nuclear Research Facility GmbH's Institute for Solid State Research have succeeded in manufacturing a high temperature superconductor with a transition temperature of 130 Kelvin (-3°C). [Passage omitted]

The superconductor developed at Juelich is a compound of bismuth, lead, antimony, strontium, calcium, copper, and hydrogen. This mixture had been proposed by PRC scientists in Hefei. It was produced in Juelich and subjected to extended controlled heat treatment at 160° C. In the course of about 3 weeks it was possible to raise the transition temperature systematically from an initial 100 Kelvin to a record level of 130 Kelvin.

Confirmation that the spectacular result at Juelich constitutes a new world record or is merely a European first must await news of a transition temperature of 165 Kelvin allegedly reached in China using the same mixed oxide system. This would mean that science has advanced by 35° Kelvin (to -108° C) toward its "dream" of room-temperature superconductivity.

Meanwhile, Juelich has also used a sintering process to produce the first films of the new superconducting material which show an initial transition temperature of 105 Kelvin. Just a few weeks ago scientists at the Juelich Institute for Coatings and Ion Technology developed the fastest process for producing thin layers of high temperature superconductors using "vaporization" after laser-beam bombardment.

COMPUTERS

Hungarian Geophysical Expert System Described
25020245 Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 15 Apr 89 p 2

[Article by Csaba Toth: "A Bauxite-Geophysical Expert System"]

[Text] This is an experimental model developed at the Hungarian State Lorand Eotvos Geophysical Institute during 1987-88 which can be used in solid mineral geophysical prospecting. This is the first such program in the area of geophysical research and mining in Hungary. The purpose of the geophysical measurements is to find possible bauxite deposits. Since bauxite cannot be found directly on the basis of its physical parameters its presence is concluded on the basis of a study of the formations above and below it. The depth conditions and the geological-geophysical model crucially determine the applicability of various geophysical methods. On this basis they select the few needed for concrete studies from among the some twenty methods presently available.

With the aid of a knowledge base the expert system draws conclusions from data in a pre-processed geological-geophysical database. For example, the probability of the occurrence of bauxite at a given point, in the vicinity of a point or in a prospecting area can be determined. One can establish which geophysical measurement method must be used at a given point or in a given area in order to increase the reliability of the conclusion. The program also performs many other functions such as modification or display of the knowledge base and justifying and explaining the conclusions.

In coming to a conclusion the system always examines the occurrence of bauxite under strictly circumscribed conditions. The knowledge of the geophysical expert is given graphically in the form of a directed net at the design level. The knowledge base consists of models and taxonomies. The model is the set of information with the aid of which the geophysical expert comes to a prediction of the appropriate material from the measurement data through a series of logical tests. In general this series of steps contains the most efficient path leading to a solution. It makes it possible to quantify the effect of the several conditions on the conclusions of the rules and to characterize the credibility of the several conclusions with probability coefficients. The taxonomies describe the hierarchy of the geophysical concepts used.

In the course of working out the knowledge base of the system it was discovered that one could not work out or apply a uniformly valid rule system for bauxite prospecting in Hungary. The reason for this is the difference in the ancient geographical conditions of the more than ten larger bauxite deposits in the Transdanubian central mountains. Indeed, there is a great deal of variation in the bauxite sites within the several occurrences which results in variation in the physical characteristics serving as a basis for geophysical prospecting. So it seemed expedient to create a different rule system for every bauxite deposit (and the individual lenses therein). Thanks to the structure of the program it is easy to use the knowledge bases developed in advance and to realize new ones.

The expert system may prompt participants to rethink prior prospecting practices and to create geological and geophysical databases which are compatible with one another. The databases to be created must be suitable for serving conversational geophysical workstations connected to a large computer. Practical testing of the program begins this year, primarily with an evaluation and analysis of geophysical measurement data to find near-surface domestic bauxite. Marketing abroad is also possible, primarily via expeditions for hire or in connection with various instruments sold by the ELGI [Lorand Eotvos Geophysical Institute]. The OMFB [National Technical Development Committee] provided 1.6 million forints in support and 960,000 forints of this must be paid back in this way in 1989-90.

At present the software runs on a computer compatible with the IBM PC/AT. The hardware requirements are 640 kilobytes RAM, one floppy disk unit, a 20 megabyte Winchester and a color monitor. The language of the program is Turbo Pascal 4.0. The built-in software consists of Flash-up Windows for general window and menu management and the Inference Engine. The SZAMALK [Computer Technology Applications Enterprise] also aided the development.

FACTORY AUTOMATION, ROBOTICS

Survey Summarizes Hungarian CAD/CAM Systems
25020246 Budapest COMPUTERWORLD/ SZAMITASTECHNIKA in Hungarian 15, 22, 29 Apr 89

[Compilation by Gitta Takacs: "CAD/CAM Program Packages"]

[15 Apr 89, pp 12-13]

[Text] The following data were obtained from the developing or vending firms and reflect prices as of February 1989. The categories are: 1. Name of the software; 2. Developer/manufacturer; 3. Vendor; 4. Applications area; 5. Chief characteristics; 6. Geometric data format; 7. Version (versions); 8. Modules; 9. Hardware; 10. Memory requirement; 11. Operating System; 12. Screen mode; 13. Data input devices; 14. Output devices; 15. Price (without tax, in forints); 16. Services; 17. Number of domestic sales; 18. Reference sites; and 19. Notes.

1. BIGRAPH; 2. Graphisoft Small Cooperative; 3. Graphisopft Small Cooperative; 4. General engineering design; 5. Interactive graphic 2-D designing; 6. 2-D; 7. Version 1.04; 8. [no data]; 9. AT, PS/2, with coprocessor;

10. 2 megabytes RAM, 20 megabyte hard disk; 11. MS-DOS 3.3; 12. EGA, Super EGA, VGA, Artist 1, Artist 10, etc.; 13. Mouse, tablet, digitizer, keyboard; 14. Plotter, printer; 15. 390,000 forints; 16. Three day study course, 1 year guarantee, new versions free of charge; 17. 30 domestic sales; 18. April 4 Machine Factory, Vegyterv [Chemical Industry Designing Enterprise], Eroterv [Power Plant Designing Enterprise], Energy Management Institute, Paks Nuclear Power Plant, Hungarian Post Office; 19. There is a significant (50-67 percent) price concession if several copies are purchased; has Hungarian language user documentation.

1. RAPID; 2. Graphisoft Small Cooperative; 3. Graphisoft Small Cooperative; 4. Pipe network design; 5. Interactive graphics, 2-D and 3-D designing; 6. 2-D, 3-D; 7. [no data]; 8. Preparation of pipe connection plans, symbolic construction of operating environment, isometric design of pipe sections, detailed materials listing, 3-D modelling, protective distance conflict study, symbol library, mountings database, environmental construction element database; 9., 10., 11., 12., 13., 14. [no data, or same as above]; 15. 1,150,000 forints; 16. Two week study course, 1 year guarantee, new versions free of charge, telephone consulting service during time of guarantee; 17. Twentyeight systems put in operation at 10 firms; 18. April 4 Machine Factory, Vegyterv, Eroterv, Energy Management Institute, Paks Nuclear Power Plant, Olajterv [Petroleum and Gas Industry Designing Enterprise], Melyepterv [Civil Engineering Designing Enterprise], Kobanya Pharmaceutical Factory; 19. Finished databases and a symbol library are accessories for the program package; has Hungarian language user documentation; there is a significant (50-67 percent) price concession if several copies are purchased.

1. VIDRA 2D; 2. Videoton Developmental Institute; 3. Videoton Computer Subsidiary; 4. Architectural, mechanical, etc.; 5. General purpose 2-D graphics editor; 6. 2-D; 7. Version 2.3; 8. [no data]; 9. VT 32 or VT 320, with graphics subsystem; 10. 512 kilobytes RAM, 40 megabyte hard disk; 11. DMOS 3.2 (UNIX V.2 compatible); 12. CGI standard graphics interface; 13. Mouse or tablet, keyboard; 14. Plotter, high resolution color monitor, VT 21x00 matrix printers; 15. 500,000 forints; 16. Instruction, consulting, software follow-up, 1 year guarantee; 17. One domestic sale; 18. BME [Budapest Technical University] Process Control Faculty; 19. There have been 32 foreign sales; delivery time with hardware is 6 months, within one month if hardware is already in operation; has Hungarian language documentation.

1. VIDRA 3D; 2. Videoton Developmental Institute; 3. Videoton Computer Subsidiary; 4. Architectural, mechanical, design work; 5. A 3-D geometric modelling system; 6. 3-D; 7. Version 2.2; 8. and 9. [no data or same as above]; 10. 1.7 megabyte RAM; 11., 12. and 13. [no data or same as above]; 14. Plotter; 15. 700,000 forints; 16. Instruction, consulting, 1 year guarantee, software follow-up and maintenance; 17. One domestic sale; 18. BME Process Control Faculty; 19. There have been 21 foreign sales; drawing and data files can be prepared for the VIDRA 2D graphics editor; delivery time with hardware is 6 months, within 1 month if hardware is already in operation.

1. MAID; 2. Videoton Developmental Institute; 3. Videoton Computer Subsidiary; 4. Drive design (mechanical); 5. A system to design drives (for geometric design of constant ratio, no stage and multiple step drives, can be used for strength and tribological dimensioning and checks); 6. 2-D, 3-D; 7. Version 1.0; 8. Kinematic outline, pre-design of geared element pairs, axle diameter, hub and wheel design, rolling bearing design, tribological calculations, etc., ten modules in all; 9. [no data or same as above]; 10. 2 megabytes RAM, 40 megabyte hard disk; 11. and 12. [no data or same as above]; 13. Keyboard, tablet; 14. plotter, high resolution color monitor, VT 214xx printers; 15. 950,000 forints (marketing begins in second quarter of 1989); 16., 17. and 18. [no data]; 19. Hungarian language documentation being prepared; delivery time with hardware is 6 months, within 1 month if hardware is already in operation—beginning in July.

1. BOARDSTAR CAD System; 2. Videoton Developmental Institute, Academi-EIS (Swiss); 3. [no data]; 4. Electronics, logical design, design of printed circuit cards; 5. Logical designing (symbol management, wiring list generation, etc.), card design (automatic transfer of parts and wiring data from logical design module, system library with physical data on card types, can handle maximum of 64 layers, plotter and NC drilling tape output, can use surface mounting technology, etc.); 6. 2-D; 7. Version 1.0; 8. and 9. [no data]; 10. 4 megabytes RAM, 40 megabyte hard disk; 11. and 12. [no data]; 13. Keyboard, tablet; 14. plotter, light plotter, high resolution color monitor, VT 21x00 matrix printer; 15. Being established (sale of the program package will begin in the second half of the year); 16., 17. and 18. [no data]; 19. Hungarian language documentation being prepared; delivery time with hardware is 6 months, within 1 month if hardware is already in operation—beginning in July.

1. PC/Board; 2. MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences]; 3. Softcare group and retailers (Instrument Technology and ITEX); 4. Design of electric and electronic circuit diagrams, block diagram design, printed circuit layout and wiring design; 5. Handles multi-chip circuits, prepares parts lists, continuous zoom, check of manual and automatic design rules, parts library, simulation outputs; 6. OrCad and EDIF converter; 7. Version 3.3; 8. Twenty modules; 9. XT, AT 286/386, PS/2, with or without coprocessor; 10. 640 kilobytes RAM, 10 megabyte hard disk; 11. MS-DOS 3.x; 12. CGA, EGA, VGA or optional CAD/CAM monitor; 13. Keyboard, mouse, digitizer; 14. matrix printers, pen plotters, photo plotter, laser plotter, NC drilling machine; 15. Characteristic package prices are 119,000, 179,000, 350,000 and 580,000 forints (prices of modules range from 35,000 to 350,000 forints); 16. One year

guarantee, 1 year free software follow-up, after that new versions at favorable prices; 17. Ten domestic sales; 18. BEAG [Budapest Electroacoustics Factory], BRG [Budapest Radio Technology Factory], Ganz Instrument Works; 19. A page reading input possibility is under development; Hungarian language handbook with full description of interface surfaces; on the basis of the output data files of the system the HITELAP company will manufacture, at a favorable price, the master film set, the NC drill tape, experimental samples, etc. and will also undertake some of the designing tasks.

1. FFS (Free-Form Shapes) CAD/CAM; 2. MTA SZTAKI; 3. FLEXYS Manufacturing Automation Company; 4. Machine tool design and manufacture (synthetics industry, porcelain and glass manufacture, forging tools, casting samples, etc.); 5. A 3-D surface modelling system for designing and machining bodies defined by free form surfaces; 6. 3-D geometric model; 7. PC-DOS, VAX/VMS, or 2D, 3D, 3D+ and 5D; 8. Modules supporting 2-D and 3-D curve and surface design, 2.5 D blocking out, 3-D smoothing, 5-D processors, postprocessor; 9. AT, VAX, VT32; 10. 640 kilobytes RAM, 20 megabyte hard disk; 11. MS-DOS 3.x, VMS, DMOS; 12. EGA+ monochrome alphanumeric screen, with PC-GD card (a SZTAKI development), Tektronix 40/41 or emulation 1024 x 768 resolution graphic display; 13. Menu technique with alphanumeric monitor; 14. HP 7475A A/3 size plotter or devices supporting the HPGL language; 15. 413,000 forints (2D), 825,000 (3D), 1,350,000 (3D+) or 1,650,000 forints (5D); 16. Training (1 week), 1 year guarantee, matching to hardware/software environment deviating from that described; 17. [no data]; 18. Csepel Tool and Apparatus Manufacturing Company (PC version), Ikarus (VAX version); 19. On the basis of the designed surface geometry the system automatically produces the control tapes for NC milling machines needed for blocking out and smoothing operations; Hungarian or English language documentation.

1. CAD-A; 2. MTA KFKI [Central Physics Research Institute of the Hungarian Academy of Sciences]; 3. Department for Computerized Designing Systems of the Measurement and Computer Technology Research Institute of the MTA KFKI; 4. Mechanical design and manufacture; 5. Defining and modifying geometric elements, developing parts families, setting view and projection, generating NC data, etc.; 6. 2-D, 3-D surface and body model; 7. and 8. [no data]; 9. Computers in the TPA 11/500 series; 10. 8 megabytes RAM, about 40 megabytes background; 11. MOS-VP; 12. Tektronix 41xx; 13. Mouse, tablet; 14. HP or CAlComp plotter, HP laser printer; 15. 2,700,000 forints; 16. Instruction; 17. Four domestic sales; 18. Ikarus, Raba, MTA SZTAKI, BME; 19. There are Hungarian language aids.

1. CAD-E; 2. MTA KFKI; 3. [same as above]; 4. Mechanical design and manufacture; 5. A 3-D body modelling system (set operations, geometric transformations, free form curves and surfaces, articulated mechanisms, etc.); 6. 2-D, 3-D body model; 7. and 8. [no data]; 9. [same as above]; 10. 8 megabytes RAM, about 80 megabytes background; 11. [same as above]; 12. Tektronix 4014, 4115; 13. Mouse; 14. [same as above]; 15. 4,000,000 forints; 16. Instruction; 17. Seven domestic sales; 18. Ikarus, Raba, MTA SZTAKI, BME, Tungsram, MOM [Hungarian Optical Works], UVATERV [Road and Railroad Planning Enterprise]; 19. There are Hungarian language aids.

1. CAD-F; 2. MTA KFKI; 3. [same as above]; 4. Finite element analysis system; 5. Determination of stress and strain fields, static and dynamic loading, intrinsic vibration and frequencies, etc.; 6. 2-D, 3-D; 7. and 8. [no data]; 9. [same as above]; 10. 8 megabytes RAM, about 80 megabytes background; 11. [same as above]; 12. Tektronix 41xx; 13. Mouse; 14. [same as above]; 15. 1,900,000 forints; 16. Instruction; 17. Three domestic sales; 18. Ikarus, Raba, MTA SZTAKI; 19. No Hungarian language aids.

1. CAD-P; 2. MTA KFKI; 3. [same as above]; 4. Finite element pre and postprocessor; 5. Interactive graphic pre and postprocessor to create and analyze 3-D finite element models; 6. 2-D, 3-D; 7. and 8. [no data]; 9. [same as above]; 10. 8 megabytes RAM, about 10 megabytes background; 11. [same as above]; 12. Tektronix 4014, 41xx; 13. Mouse; 14. [same as above]; 15. 1,900,000 forints; 16. Instruction; 17. Four domestic sales; 18. Ikarus, Raba, MTA SZTAKI, BME; 19. There are Hungarian language aids.

1. MONOFEM; 2. Comporgan; 3. Comporgan Engineering Services Subsidiary (CEC); 4. Mechanical, architectural and civil engineering; 5. A mechanical program package working with the finite element method; 6. 2-D; 7. Version 1.0 (for flexible deformations), version 2.0 (for flexible-plastic deformations); 8. preprocessor (geometric data input, net generation, input of materials data, giving limit conditions and loading data), computing module (reserializing finite element solver), postprocessor (evaluation of computed stresses and strains); 9. XT, AT, with coprocessor; 10. 512 kilobytes RAM, 10 megabyte hard disk; 11. MS-DOS 2.1-; 12. EGA; 13. Mouse; 14. HP 7475 plotter, Epson printer; 15. 352,000 forints (version 1.0), 384,000 forints (version 2.0); 16. One year guarantee, program follow-up, instruction; 17. Three domestic sales; 18. Pecs Ore Mine; 19. The program package can be leased and they will undertake to run it for hire; Hungarian and German language operator's handbook.

1. FEM-3D; 2. Comporgan Engineering Services Subsidiary (CEC), Heavy Industry Technical University (Miskolc); 3. [no data]; 4. Mechanical, architectural; 5. A mechanical program package working with the finite element method; 6. 2-D, 3-D; 7. [no data]; 8. 3-dimensional sheet and rod structures, plane reducible tasks

(sheet, planar deformation, plane stress, axle symmetric), 3-D continuums; 9. AT, with coprocessor; 10. 640 kilobytes RAM, 20 megabyte hard disk; 11. MS-DOS 2.2-; 12. EGA (640 x 350 pixels); 13. Mouse; 14. HP plotter, Epson printer; 15. 660,000 forints (about 50,000 forints per module); 16. One year guarantee, program follow-up, training; 17. Two domestic sales (from November 1988 to January 1989); 18. Diosgyor Machine Factory, Veszprem Coal Mines; 19. The program package can be leased and they will undertake to run it for hire; Hungarian language help system and operating instructions.

1. TPS 10; 2. T Programm GmbH (FRG); 3. Eroterv III Office (Hungarian agent); 4. Construction industry, mechanical, etc.; 5. A finite element program package for static, dynamic, non-linear material behavior potential problem calculations; 6. 3-D; 7. PC version, mainframe version; 8. The modules of the PC version are: graphic finite element preprocessor, modules for static, dynamic, non-linear potential areas, graphic finite element postprocessor; 9. AT, with coprocessor, mainframe systems (Cray, HP, IBM, Siemens, Celerity, etc.); 10. 640 kilobytes RAM, 30 megabyte hard disk; 11. MS-DOS 3.2; 12. EGA; 13. Mouse; 14. HP compatible plotters; 15. To be paid for in foreign exchange, depends on number of copies, also available by module, one copy of the PC version is about 50,000 DM; 16. Guarantee, instruction according to agreement, new versions are free during guarantee time, when switching to a new computer or operating system only the price difference must be paid; 17. [no data]; 18. Eroterv; 19. Hungarian language handbook; the masks of the preprocessor are in Hungarian; Eroterv will undertake to run the program for hire.

[22 Apr 89, pp 12-13]

1. ASKA; 2. IKOSS (FRG); 3. SZAMALK; 4. Statics and strength testing, dynamic analysis, stability studies, study of material non-linearities, contact studies, stationary and transient heat conduction tasks; 5. [no data]; 6. 3-D; 7. Version 8.6; 8. Interactive graphics preprocessor, linear statics, linear dynamics, temperature analysis, material non-linearity, linear buckling, interactive graphics postprocessor; 9. MicroVAX II or VAX 11/700 series (or computers compatible with them); 10. 2 megabytes RAM, 600 megabytes background; 11. VMS 4.3-; 12. [no data]; 13. Alphanumeric terminal, high resolution color graphics terminal (e.g., TEK 4125); 14. High resolution color graphics terminal, plotter; 15. About 6,000,000 forints; 16. One year guarantee and program follow-up, instruction, training, telephone consultation service; 17. and 18. [no data]; 19. The services of the program package can also be used on the basis of contract; documentation is in 10 volumes, in the English language.

1. GORDIUSZ; 2. SZAMALK Technical Applications Main Department; 3. [no data]; 4. Data preparation for mechanical finite element program packages; 5. 3-D finite element net modelling; 6. 3-D; 7. Basic version; 8. [no data]; 9. AT; 10. 640 kilobytes RAM, 20 megabytes hard disk; 11. [no data]; 12. EGA; 13. [no data]; 14. Printer, plotter; 15. 150,000 forints; 16. Put into operation, training, technical consulting, program follow-up; 17. and 18. [no data]; 19. Hungarian language documentation; delivery time, April 1989; after suitable conversion the net model created can be fitted to any computing program, at present they have an ASKA and SUPERSAP link.

1. HEDI; 2. SZAMALK Technical Applications Main Department; 3. [no data]; 4. Thermal analysis during mechanical, architectural and construction mechanical designing; 5. Heat flow network modelling; 6. 2-D; 7. Basic version; 8. Interactive graphic network modelling, generation and solution of network equations; general diagram display; 9. and 10. [no data]; 11. MS-DOS 3.1-; 12. [no data]; 13. Keyboard, mouse; 14. Printer, plotter; 15. 170,000 forints; 16. and 17. [no data]; 18. Hajdusag Industrial Works; 19. Hungarian language documentation; delivery in May 1989.

1. HOMAR; 2. SZAMALK Technical Applications Main Department; 3. [no data]; 4. General mechanical, construction mechanical, architectural, electric and electronic areas; 5. A general framework system for engineering computations, computerized planning of routine engineering design tasks (e.g., dimensioning); 6. 2-D (can be connected to plotting programs); 7. Basic version; 8. Framework system, computing modules; 9., 10. and 11. [no data]; 12. CGA, EGA, Hercules; 13. [no data]; 14. Printer; 15. 120,000 forints (framework system), the price of the computing modules varies depending on complexity; 16. Putting framework system into operation, adapting it, training, technical consulting for processing computations, program follow-up; 17. and 18. [no data]; 19. Hungarian language documentation; delivery time for basic version of framework system, April 1989; developmental tools and technical computations, June 1989.

1. TRIOLA; 2. SZAMALK-Novotrade; 3. SZAMALK-Novotrade; 4. Mechanical; 5. 3-D body modelling, set operations, conflict study, surface and volume calculation, NC program generation, finite element net generation; 6. 3-D body model; 7. and 8. [no data]; 9. AT 286/386 or PS/2, with coprocessor, or Mikrosztar 32; 10. 1.5 megabytes RAM (of which, in the case of the AT/286, 1 megabyte is on the LIM-EMS expansion card); 11. MS-DOS, VMS; 12. EGA, VGA, Hercules or Tektronix 41xx terminals; 13. Mouse (from Microsoft 5.3); 14. HP compatible plotters; 15. 450,000 forints; 16. Two year software follow-up (delivery of new versions), training; 17. [no data]; 18. Hajdusag Industrial Works, Donat Banki Machine Industry Technical College, Industrial Technology Institute; 19. TRIOLA can take contours from AutoCAD, CADkey, PC-DRAFT and CADdy programs and from every 2-D system using the DXF file format and it can prepare section and view drawings which can be interpreted for these programs.

1. ARCAD; 2. 5G Small Cooperative and Rair Ltd.; 3. 5G Small Cooperative; 4. Architecture; 5. Archictectural and technological design, technical drawings, material need and cost calculations; 6. 2-D, 3-D; 7. Version 4.0; 8. Architecture module, 2-D graphics editor, 3-D modeller, material need and budget calculating module; 9. XT, AT, coprocessor recommended; 10. 640 kilobytes RAM, 1.2 megabyte floppy or hard disk; 11. MS-DOS 3.0-; 12. EGA, CGA, Hercules; 13. Keyboard, mouse, digitizer; 14. Plotter, printer; 15. 220,000 forints; 16. One year guarantee, training, on-site installation; 17. Seven domestic sales; 18. Elgep [Foodstuffs Industry Machine Factory and Assembly Enterprise], Tervszov Small Cooperative (Kaposvar); 19. The system is sold in Western Europe under the name CADARC; Hungarian language menu and user instructions; can be linked to AutoCAD and dBASE III Plus systems; a version which can be run in a network will probably reach the market in June.

1. ARCHICAD-PC; 2. Szenzor-CAD Ltd.; 3. Szenzor-CAD Ltd., Softinvest; 4. Architecture, architectural interiors; 5. True 3-D solid body modeller; 6. 3-D; 7. Version 2.0; 8. Basic plan design, 3-D modelling, section preparation, graphic database maintenance, budget preparation; 9. AT, with coprocessor; 10. 640 kilobytes RAM, 20 megabyte hard disk; 11. MS-DOS 3.x; 12. EGA; 13. Mouse, digitizer; 14. Plotter; 15. 225,000 forints; 16. One year guarantee, training, 2 day on-site course; 17. Twenty domestic sales; 18. FUTI [Capital Construction Industry Business and Management Office], Iparterv [Industrial and Agricultural Planning Enberprise]; 19. A new version of ARCHICAD will probably appear in the second half of the year; the program package is also sold in Western Europe, the number of sales is around 50.

1. AutoCAD; 2. Autodesk (USA); 3. Oktatrend, Instrument Technology (Innova-CAD), COSY [Cooperative Systems, a subsidiary of MTA SZTAKI]; 4. Architectural, mechanical, general engineering design, etc.; 5. [no data published]; 6. 3-D; 7. Release 10; 8. More than 15,000 supplementary modules, e.g. for architectural, electronic, mechanical, geodesic and graphic areas; 9. AT 286/386; 10. 640 kilobyte RAM, 10 megabyte hard disk; 11. MS-DOS 3.2-; 12. EGA, VGA, CGA, Hercules (one or two monitors); 13. Mouse, digitizer; 14. Plotter, printer; 15. 590,000 forints; 16. One year guarantee, free software follow-up for 2 years; 17. Forty domestic sales by Oktatrend, 5 by COSY and 4 by Innova-CAD; 18. Agrober [Agricultural Design and Investment Enterprise], Hajdu County State Construction Industry Enterprise, Hungarian Industrial Arts College; 19. A Hungarian language version is being prepared and is expected to appear in May 1989; there is a price concession if more than two copies are purchased; Innova-CAD, Oktatrend and COSY all sell the program to educational institutions for 20-25 percent of the price.

1. PC-DRAFT; 2. RHV (FRG); 3. Instrument Technology (Innova-CAD); 4. Architectural, mechanical, general engineering activity; 5. [no data published]; 6. 2-D, 2.5-D; 7. Version 6.3x; 8. Alternates generating module, NC module, perspective drawing module; 9. AT 286/386, with coprocessor; 10. 640 kilobytes RAM; 11. MS-DOS; 12. EGA, VGA, Hercules, etc. (one or two monitors); 13. Mouse, digitizer; 14. Plotter, printer; 15. 690,000 forints; 16. One year guarantee, instruction; 17. [no data]; 18. Telephone Factory; 19. Hungarian language handbook being published; price concession for purchase of more than 2 copies; educational institutions can purchase it for 20-25 percent of the price.

1. CADkey; 2. CADkey Inc. (USA); 3. Instrument Technology (Innova-CAD); 4. Architectural, mechanical, general engineering design; 5. [no data published]; 6. 3-D; 7. Version 3.12; 8. 3-D designing, solid body analysis; 9. AT 286/386; 10. 640 kilobytes RAM; 11. MS-DOS; 12. EGA, VGA, Hercules; 13. Mouse, digitizer; 14. Plotter, printer; 15. 680,000 forints; 16. One year guarantee, software follow-up; 17. and 18. [no data]; 19. Hungarian language documentation being prepared; price concession when purchasing more than 2 copies; educational institutions can purchase it for 20-25 percent of the price.

1. CADdy; 2. Ziegler (FRG); 3. COSY; 4. Mechanical, electronic, electrotechnical, road construction, cartography, etc.; 5. [no data published]; 6. 2-D, 3-D surface and body model; 7. Version 4.1; 8. [no data published]; 9. AT, with coprocessor; 10. 640 kilobytes RAM, 20 megabyte hard disk; 11. MS-DOS 3.0-; 12. EGA; 13. Mouse, tablet; 14. plotter; 15. The basic, mechanical and body model modules and the Hasco element set cost 500,000 forints each, the prices of the electronic modules range from 500,000 to 700,000 forints; 16. One year guarantee; 17. Six domestic sales; 18. Heavy Industry Technical University (Miskolc), MEM [Ministry of Agriculture and Food] Technical Institute (Godollo); 19. [no notes published].

1. SYSCAD; 2. SYSGRAPH (Austria); 3. Mikropo Small Cooperative; 4. Mechanical; 5. Control of 2.5-5 axis machine tools, post-processor configuration possible, offers services similar to VersaCAD, AutoCAD, etc. for designing tasks, the machining tasks supported are drilling, holing, milling and turning; 6. 3-D; 7. [no data]; 8. NC program package, 3-D module, mechanical symbol library; 9. UNIGRAPH 386/286 twin processor system (graphics and writing processor), with 1280 x 1024 resolution screen, alphanumeric terminal; 10. [no data]; 11. XENIX; 12. EGA, VGA, etc.; 13. Mouse, digitizer; 14. Plotter; 15. 8,500,000 forints (hardware and software), 1,280,000 forints (NC module), 1,120,000 forints (3-D module), 280,000 forints (mechanical symbol library); 16. One year guarantee, new versions free of charge, training in Austria at SYSGRAPH training center; 17. [no data]; 18. Demonstration site, Lampart; 19. English language instruction set and documentation; the Mikropo Small Cooperative provides customer service for SYSGRAPH in Hungary; the workstation can be connected to an Ethernet network.

1. Drafix; 2. Foresight Resources Corp. (USA); 3. DIGIT Computer Technology Company (Szekesfehervar); 4.

Mechanical; 5. General 2-D drafting and designing system; 6. 2-D; 7. Versions 1.0 and 1.5; 8. [no data published]; 9. XT; 10. 640 kilobytes RAM, 20 megabyte hard disk; 11. MS-DOS 3.x; 12. EGA; 13. Digitizer; 14. Plotter; 15. 35,000 forints (1.0), 70,000 forints (1.5); 16. One year guarantee; 17. Two domestic sales; 18. DIGIT Computer Technology Company (Szekesfehervar); 19. The 1.5 version can be interfaced with AutoCAD, text editor and other programs.

1. A deep drawing technological and tool design system; 2. Mechanical Technologies Faculty of the Heavy Industry Technical University (Miskolc); 3. Heavy Industry Technical University (Miskolc); 4. Machine manufacturing technology; 5. Versions of the program package are: planning deep drawing of cylindrical parts, planning deep drawing of rectangular parts, a complex design system for deep drawing; 6. 2-D; 7. Versions 1.1, 1.2 and 2.1; 8. A parts geometric description module, a cylindrical part design module, a rectangular part design module, a forming machine selection module, a database management module and a documentation module; 9. AT; 10. 640 kilobytes RAM, 20 megabyte hard disk; 11. MS-DOS 3.1; 12. EGA, Super EGA, CGA, Hercules, HP Vectra, Olivetti, Tektronix; 13. Digitizer, mouse; 14. HP compatible plotter, Epson compatible printer; 15. 100,000 forints (1.1), 100,000 forints (1.2), 150,000 forints (2.1); 16. One year guarantee, training, program follow-up; 17. [no data]; 18. Hajdusag Industrial Works, the G/6 Program Office; 19. Hungarian language instruction set and documentation; the program package can be leased.

1. A sheet forming technological and tool design system; 2. Mechanical Technologies Faculty of the Heavy Industry Technical University (Miskolc); 3. and 4. [as above]; 5. [no data]; 6. 2.5-D; 7. [no data]; 8. A parts geometric description module, a strip designing module, a technological design module, a compiled tool drafting module and a parts drawing preparation module; 9., 10. and 11. [no data]; 12. EGA, Super EGA, Hercules; 13. and 14. [no data]; 15. 200,000 forints; 16. and 17. [no data]; 18. The G/6 Program Office; 19. Hungarian language instruction set and documentation; delivery within 3 months of order; the program package can be leased.

[29 Apr 89, pp 12-13]

1. MIGEO; 2. Uvaterv [Road and Railroad Planning Enterprise]; 3. Uvaterv; 4. Architectural and civil engineering, map editing; 5. An interactive engineering geodesic program system, connects to the LITMOR installation design integrated site modelling and planning program system; 6. 2-D, 3-D; 7. and 8. [no data]; 9. XT, AT; 10. 640 kilobytes RAM, 1.2 megabyte floppy; 11. MS-DOS 3.1; 12. EGA; 13. Keyboard, floppy disk; 14. Plotter (matching on order); 15. 110,000 forints (data input module 20,000, evaluation module 30,000, drafting module 60,000 forints); 16. One year guarantee, program follow-up, training; 17. [no data]; 18. Uvaterv; 19. The data files produced by the program can also be processed with the AutoCAD program.

1. MIFRA; 2. and 3. [as above]; 4. Structure design; 5. For computation of the internal forces and deformations of planar rod structures; 6. 2-D, 3-D; 7. and 8. [no data]; 9., 10., 11. and 12. [no data; presumably all the Uvaterv programs (except the last, MILI) have the same hardware requirements]; 13. Keyboard; 14. [no data]; 15. 60,000 forints; 16., 17., 18. and 19. [no data].

1. TERA; 2. and 3. [as above]; 4. Architectural design; 5. An interactive modelling program system for optimal formation of construction sites; 6. 3-D; 7. [no data]; 8. Interactive data definition subsystem, command language subsystem, graphics subsystem (preparation of projection, axonometric and perspective drawings); 9., 10., 11. and 12. [as above]; 13. Keyboard, digitizing tablet, floppy disk; 14. [no data]; 15. 1,200,000 forints; 16., 17. and 18. [no data]; 19. The TERA system was prepared with OMFB [National Technical Development Committee] support; English, French and German language versions can be delivered; they also undertake design services with the TERA software.

1. MICHA; 2. and 3. [as above]; 4. Sewerage system design; 5. Interactive, for preparation of studies on and plans for sewerage and run-off systems; 6. 3-D (graphic display is 2-D); 7. [no data]; 8. Data input and modification, hydraulic dimensioning, drafting, static dimensioning, pipe distribution, volume calculations; 9., 10., 11. and 12. [as above]; 13. Keyboard, floppy disk; 14. Printer, plotter (matching on order); 15. 260,000 forints; 16., 17. and 18. [no data]; 19. The MICHA system was developed with the support of the G/1 research and development program of the OMFB.

1. MILASCA; 2. and 3. [as above]; 4. Site preparation; 5. Earth mass computation, computation of earth mass movement tasks; 6. 3-D (graphic display is 2-D); 7. [no data]; 8. Site data subsystem, route data subsystem, earth mass computation and distribution subsystem, drafting subsystem; 9., 10., 11. and 12. [as above]; 13. and 14. [no data]; 15. 140,000 forints (the site data and route data subsystems 20,000 each, the earth mass computation and drafting subsystems 50,000 forints each); 16., 17. and 18. [no data]; 19. Preparation of site preparation plans will be undertaken with the MILASCA program, with Hungarian, English or French inscriptions; they will also undertake to adapt the program to other computer types.

1. MILI; 2. and 3. [as above]; 4. Lighting technology; 5. A program system to design interior artificial lighting of buildings; 6. 2-D; 7. and 8. [no data]; 9. XT, AT, TPA 11/580, VAX compatible computers; 10., 11. and 12. [no data]; 13. Keyboard; 14. Plotter (matching on order); 15. 100,000 forints (plus installation and adaptation costs); 16. and 17. [no data]; 18. Uvaterv (on a PC and on a

TPA 11/580); 19. They will undertake to load the databank with light source data corresponding to the desired standards.

1. MIKROVIZTER; 2. EGSZI [Construction Management and Organization Institute] Systems House Ltd.; 3. EGSZI Systems House Ltd.; 4. Construction of waterworks and water pipe networks; 5. Network dimensioning program (for looped water networks, to produce pipe diameter combinations; maximum of 30 pumps, 40 reservoirs and 300 nodes can be in the system); 6. 2-D; 7. Version 2.2; 8. [no data]; 9. XT, AT; 10. 512 kilobytes RAM, 1.2 megabyte floppy; 11. MS-DOS 3.0-; 12. EGA, CGA, Hercules; 13. Keyboard, digitizer; 14. Printer; 15. 95,000 forints; 16. One year guarantee, new versions at favorable price; 17. Twentyfive domestic sales; 18. Melyepterv [Civil Engineering Designing Enterprise]; 19. [no notes].

1. GAZTER; 2. and 3. [as above]; 4. Gas line construction; 5. For dimensioning of low and medium pressure gas networks (there can be a maximum of 300 nodes in the system); 6. 2-D; 7. Version 2.2; 8. [no data]; 9., 10. and 11. [no data, presumably as above]; 12. EGA, CGA, Hercules; 13. Keyboard, digitizer; 14. [no data, presumably as above]; 15. 95,000 forints; 16. [no data, presumably as above]; 17. Twentytwo domestic sales; 18. Capital Civil Engineering Designing Enterprise; 19. [no notes].

1. WLEMEZ; 2. and 3. [as above]; 4. Architectural; 5. Finite element statics computation of orthotropic panel structures which can be flexibly bedded; 6. 2-D; 7. Version 2.4; 8. [no data]; 9., 10. and 11. [as above]; 12. EGA, CGA; 13. Keyboard; 14. [as above]; 15. 98,000 forints; 16. [as above]; 17. Ten domestic sales; 18. General Construction Industry Designing Enterprise; 19. [no notes].

1. UTVIL; 2. and 3. [as above]; 4. Public lighting design; 5. An interactive program designing public square and road lighting (with a maximum of 40 lamps); 6. 2-D; 7. Version 1.1; 8. [no data]; 9., 10. and 11. [as above]; 12. EGA, CGA; 13. Keyboard; 14. [as above]; 15. 65,000 forints; 16. [as above]; 17. Two domestic sales; 18. Capital Civil Engineering Designing Enterprise; 19. [no notes].

1. AMORF; 2. and 3. [as above]; 4. Glass, paper, furniture, textile industry, etc.; 5. Preparation of optimal cutting plans from amorphous parts; 6. 2-D; 7. Version 1.0; 8. AMORF-I only for right-angled parts, AMORF-II for amorphously shaped parts, AMORF-III is an amorphous parts editing program; 9. XT, AT (coprocessor recommended); 10. 640 kilobytes RAM, 10 megabyte hard disk; 11. [no data, presumably MS-DOS 3.0-]; 12. EGA (recommended); 13. Digitizer; 14. Graphics printer (minimum 80 character), plotter; 15. 270,000 forints; 16. [no data, presumably as above]; 17. Four domestic sales; 18. Csoszer; 19. [no notes].

1. MEGAGO; 2. and 3. [as above]; 4. Furniture industry, machine industry, etc.; 5. Preparation of optimal cutting plans for sheet from right-angled parts; 6. 2-D; 7. Version 3.1; 8. [no data]; 9. XT, PDP compatible computers; 10. 512 kilobytes RAM, 1.2 megabyte floppy; 11. [as above]; 12. EGA, CGA, Hercules; 13. Keyboard; 14. Printer; 15. 120,000 forints; 16. [as above]; 17. Three domestic sales; 18. Labor MIM [Laboratory Instrument Industry Works]; 19. [no notes].

1. KTR; 2. BME Mechanical Structures Institute; 3. COSY; 4. Movement simulation, layout plans, robot programming, etc.; 5. A designing system with simulation of location and time of movements; 6. 3-D; 7. Version 1.0; 8. [no data]; 9. XT, AT; 10. 512 kilobytes RAM, 10 megabyte hard disk; 11. MS-DOS 3.0-; 12. CGA; 13. Keyboard; 14. Plotter, printer (with plotter simulation); 15. 300,000 forints, 200,000 forints for educational institutions; 16. One year guarantee, software follow-up; 17. One domestic sale (as of December 1988); 18. Machine Tool Industry Works; 19. Version 2.0 can be expected by mid-1989; it will be suitable for preparation of toned images and for removal of covered lines.

1. GRAD; 2. Leather and Shoe Industry Research and Development Enterprise; 3. [the same]; 4. Shoe industry, textile industry; 5. Digitizing parts data, sample preparation, preparing contours according to sizes, producing samples; 6. 2-D; 7. Versions 2.0, 3.0 and 4.0; 8. [no data]; 9. AT; 10. 640 kilobytes RAM, 20 megabyte hard disk; 11. MS-DOS 3.x; 12. EGA; 13. Digitizing tablet; 14. Pattern cutting equipment (a development of the research enterprise), plotter; 15. About 300,000 forints (base program), the price of the special supplementary modules according to agreement; 16. Six month guarantee, instruction, new versions free; 17. [no data]; 18. Applications Technology Small Cooperative, the Leather and Shoe Industry Research and Development Enterprise; 19. An advanced version of the program was prepared on a commission from the UN Industrial Development Organization (UNIDO); UNIDO will distribute the program for developing countries.

1. GAP; 2. Applications Technology Small Cooperative; 3. [the same]; 4. Development of CAD/CAM programs; 5. A 2-D CAD/CAM applications program development environment (database manager, alphanumeric menu manager, icon interpreter, graphics editor, communications subsystem); 6. Special; 7. Version 3.0; 8. [no data]; 9. XT, AT; 10. Depends on application; 11. MS-DOS; 12. EGA, VGA, CGA, Hercules; 13. Keyboard, mouse, tablet, digitizer, page reader; 14. Plotter, printer; 15. 350,000 forints; 16. One year guarantee, software follow-up; 17. Six domestic sales; 18. SW Technological Small Cooperative, USIP (Czechoslovakia); 19. [no notes].

1. KANYAR; 2. and 3. [as above]; 4. Cartography; 5. Graphic and textual recording of map objects; 6. GAP; 7.

Version 1.1; 8. Textual database manager, communications program, list structured graphics database manager, manipulation module, display module; 9. AT, MicroVAX; 10. Textual database (on MicroVAX) 70 megabytes, graphics database (on PC) 2 x 40 megabytes; 11. MS-DOS (PC), ULTRIX (MicroVAX); 12. EGA, CGA, Hercules; 13. Keyboard, mouse, digitizer; 14. Plotter, printer, display; 15. Depends on application; 16. [no data]; 17. One domestic sale; 18. Capital Council Transportation Directorate, BKV [Budapest Transportation Enterprise], Capital Public Works Development Enterprise; 19. [no notes].

1. SPEGR; 2. Machine Tool Programming Association; 3. [the same]; 4. Machine tool programming; 5. A graphics system for preparing machine tool programs, for the HUNOR 712/721/732 lathe controls; 6. [no data]; 7. Version 1.0; 8. NC editor program, geometric processor, NC program interpreter, graphic checking program, data traffic module, running system; 9. XT, AT (with RS-232 interface); 10. 640 kilobytes RAM, 360 kilobyte floppy; 11. MS-DOS 3.x; 12. EGA (640 x 350 pixels, 16 colors), CGA (320 x 200 pixels, 3 colors or 640 x 200 pixels, one color); 13. Mouse, keyboard; 14. HP compatible plotter, Epson compatible printer; 15. 560,000 forints (prices for the individual modules range from 23,000 to 117,000 forints); 16. Six month guarantee for 3 percent of the purchase price, full year for 6 percent of the purchase price, 2 year software follow-up for 20 percent of the purchase price; 17. A new product being introduced to the market; 18. [no data]; 19. The purchase price includes on-site installation; member organizations of the Machine Tool Programming Association get a 20 percent concession; Hungarian language user documentation.

1. Flamingo; 2. Industrial Technology Institute, Aluminum Industry Machine Factory (Zalaegerszeg); 3. Industrial Technology Institute; 4. Parts manufacture; 5. A group technology designing system for creation of parts databases and technological planning of parts groups; 6. [no data]; 7. Versions 1.0 and 1.1; 8. Creation and management of parts databases, creation and management of technological databases, planning a group technology, planning unique technologies; 9. XT, AT (1.0), XT, AT, PS/2 (1.1); 10. [no data]; 11. MS-DOS 2.0-; 12. EGA; 13. Keyboard; 14. Printer; 15. 300,000 forints (with adaptation, between 500,000 and 800,000 forints); 16. Guarantee, training, new versions at favorable price; 17. [no data]; 18. Aluminum Industry Machine Factory (Zalaegerszeg), Jasbereny Chipping Machine Factory, Bekescsaba Factory of the HAFE [Drive and Elevator Factory]; 19. The program package can be leased.

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